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IMPERIAL INSTITUTE OF ENTOMOLOGY.

REVIEW
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SERIES A.

VOL. 32. 1944.

ATWOOD (C. E.) & PECK (O.). **Some native Sawflies of the Genus *Neodiprion* attacking Pines in eastern Canada.**—*Canad. J. Res.* (D) **21** no. 5 pp. 109–144, 54 figs., 29 refs. Ottawa, 1943.

In view of the increasing frequency of outbreaks of sawflies of the genus *Neodiprion* in eastern Canada in recent years and the variety of species found on the native conifers, data are given on all the native species of this genus known to attack *Pinus strobus*, *P. resinosa* and *P. banksiana* in temperate Canada, east of the Manitoba boundary; no information is available for *P. rigida*, which is native only in very small areas in the extreme south of eastern Ontario and New Brunswick, and *N. abietis*, Harr., is not included, as it has not been found on pine in this region [*cf. R.A.E.*, A **12** 56; **19** 34], and all attempts to rear it from the egg on pines have failed. It was found essential to take account of biological differences between the species in order to determine the adult characters valid for specific differentiation.

The paper is in two main sections, which are by Peck and Atwood, respectively, and deal with the identification of the adult females and of the immature forms. The first comprises a key to the females of *N. nanulus*, Schedl, *N. lecontei*, Fitch, *N. lanielensis*, sp. n., *N. pinetum*, Norton, *N. nigroscutum*, Midd., *N. ferrugineus*, Midd., *N. rugifrons*, Midd., *N. swainei*, Midd., *N. maurus*, Rohw., *N. flemingi*, sp. n., and *N. banksianae*, Rohw., followed by notes on their synonymy, distribution and distinguishing characters, and descriptions of the new species. *N. dubiosus*, Schedl [**25** 725] and *N. ontarioensis*, Midd. [**21** 350] are considered synonyms of *N. rugifrons* and *N. banksianae*, respectively. The black-headed jack pine sawfly, the brown-headed jack pine sawfly and the twin-egg sawfly [**19** 756–757] are *N. nanulus*, *N. rugifrons* and *N. swainei*.

The species in the second section are the same, with the exception of *N. nigroscutum* and *N. ferrugineus*, of which the larvae are not known, and the addition of one species of which female adults have not been reared. A key, based on the coloration of living larvae in the last feeding instar, supplemented where necessary for differentiation, by the type of egg scar pattern and details of the seasonal history, is followed by descriptions of the larvae of the various species, and notes on their food-plants, manner of oviposition and seasonal history. Parthenogenesis was observed in several of the species, only male offspring being produced.

(1878) Wt. P11/3728 1,500 1/44 S.E.R. Ltd. **Gp. 432** [A]

MacKay (M. R.). **The Spruce Foliage Worm and the Spruce Cone Worm (*Dioryctria* spp., Lepidoptera, Pyralidae).**—*Canad. Ent.* **75** no. 5 pp. 91–98, 17 figs., 6 refs. Guelph, Ont., 1943.

Dioryctria abietella, Schiff., and *D. reniculella*, Grote, the two species of the genus that occur on spruce in North America, have been much confused in the literature, as they resemble each other in the appearance of the adults, though they differ in feeding habits and seasonal history. Descriptions are therefore given of the larva, pupa, adult and genitalia of both sexes of *D. reniculella* and of the characters distinguishing those of *D. abietella*, together with data on the biology and distribution of each species in Canada.

The identity of *D. abietella* was confirmed by comparison of Canadian adults with specimens of both sexes from Finland and by the similarity of the life-history and larval morphology in Europe as described by Ratzeburg (1840). In Canada the larvae occur on the cones, twigs and buds of white spruce [*Picea glauca*] and feed mainly on the cones ; they have also been taken very occasionally on the inner bark at the base of young white pines [*Pinus strobus*]. They appear in August and spin cocoons in late September or early October, in which they overwinter before pupation. The adults emerge in early June. A form that attacks the cones of Douglas fir [*Pseudotsuga taxifolia*] and the stems of white pine on the Pacific coast is generally considered to be *D. ponderosae*, Dyar, but the characters of the latter do not differentiate it clearly from *D. abietella* and examination of the male genitalia of a single specimen suggests that it is a synonym of it.

The larvae of *D. reniculella* feed primarily on the foliage of the terminal shoots, and its food-plants comprise white, black, Engelmann and blue spruce [*Picea glauca*, *P. mariana*, *P. engelmanni* and *P. pungens*] and occasionally also balsam fir [*Abies balsamea*], larch and jack pine [*Pinus banksiana*]. It probably overwinters as a young larva, pupation occurs from 6th June to 22nd July, and the adults emerge between 16th June and 28th July. The larvae have also been found feeding on spruce cones in Saskatchewan and have been observed preying on those of the jack pine budworm [*Harmologa fumiferana*, Clem.] in north-western Ontario.

Dustan (G. G.). **The Effect of Tartar Emetic on the Greenhouse Leaf-tyer, *Phlyctaenia rubigalis* Gn.**—*Sci. Agric.* **23** no. 9 pp. 527–536, 1 ref. Ottawa, 1943.

Following the observation that sprays of tartar emetic and brown sugar used for the control of thrips reduced the population of the greenhouse leaf-tyer, *Phlyctaenia rubigalis*, Gn., in New York, investigations on their effectiveness against this Pyralid were made in Canada in 1941. In most of the tests described the larvae were bred in the laboratory and transferred to various ornamental plants for treatment and the sprays were applied mostly as a fine mist. The quantities given are per 80 gals. In the first test, the percentage mortalities after 5 days were 25·9, 61·5, 15 and 7·8 for 2 lb. tartar emetic alone and with 4 lb. brown sugar, 6 oz. sodium lauryl sulphate and 6 oz. technical mannitan monolaurate, respectively, and 83·7 for 4 lb. lead arsenate and 6 oz. sodium lauryl sulphate. When the larvae were classified as to size, all the sprays were much more effective against small larvae than against large ones. In further tests, it appeared that tartar emetic kills the larvae by stomach poisoning and by contact action, though in some cases it was not clear which was primarily responsible. A higher kill was almost always obtained when both the larvae and the foliage were sprayed than when the foliage alone was treated, and the mortality increased with the period of exposure to the tartar-emetic solution. It is thought that the sugar does not act as a bait, since larvae often died on sprayed foliage after eating very little of it, but that it may cause the spray

to form comparatively large drops, thus producing a heavy deposit, and this view is supported by the low mortality usually given when spreaders were included. A dust of tartar emetic and talc (1 : 4), applied to larvae in the last three instars that were then transferred to untreated plants, gave 40 per cent. mortality in 1 day and 88·8 in 7, and similar dusts containing 1, 5 and 10 per cent. tartar emetic applied to the larvae on plants on 29th July had given 51·4, 95·3 and 100 per cent. mortality by 30th July and 56·2, 95·3 and 100 by 4th August. The amount of feeding injury was large, moderate and very slight, respectively.

The residual effect of tartar-emetic sprays was tested by enclosing adults for 24 hours with plants sprayed a week previously ; the resulting eggs hatched 6 days later, and mortality counts were made after a further 6 days. The percentage mortalities of eggs and larvae were 7·5 and 35·8 for 2 lb. tartar emetic and 4 lb. brown sugar, 5 and 14·3 for 4 lb. tartar emetic alone, 15 and 25 when 4 lb. brown sugar was added and 4·5 and 23·3 when this was replaced by 6 oz. sodium lauryl sulphate. When plants in cages were sprayed with 2 lb. tartar emetic and 4 lb. brown sugar and adults less than 2 days old added, the periods of survival of the moths and the numbers of eggs and living larvae present 3 days after the last moths had died were much less on treated than on untreated plants ; the percentages of larval mortality ranged from 44·7 to 73·7 and were negligible in the controls. In a subsidiary test moths were shown to ingest not only the fresh spray, but also the dry residue from it.

In a greenhouse experiment, heavily infested plants were treated on 16th December with a spray of 4 lb. tartar emetic and 4 lb. brown sugar, a dust of tartar emetic and talc (5 : 95) and a spray of 4 lb. lead arsenate. On 17th December, the percentage mortalities were 65, 12·5 and 17·6, respectively, and 0 on the controls. By 5th January, the control plants were almost completely defoliated, new foliage put out on the sprayed plots was largely uninfested and few larvae were present, and some of the dusted plants were still fairly heavily infested. Uninfested potted plants were then placed among the old infested ones and sprayed with tartar emetic immediately and again on 17th January. They soon became infested by migrating larvae and even the second application did not eradicate the infestation, though few newly hatched larvae became established.

Monro (H. A. U.) & Delisle (R.). **Further Applications of Methyl Bromide as a Fumigant.**—*Sci. Agric.* **23** no. 9 pp. 546–556, 1 graph, 10 refs. Ottawa, 1943.

Since the outbreak of war in 1939, all broom corn imported into Canada has come from Argentina and has been conveyed in tightly closed railway cars from ports in the United States to Montreal, where it is fumigated. Cars arriving in summer were found to contain insect pests of stored products, chiefly *Sitotroga cerealella*, Ol., and *Laemophloeus ferrugineus*, Steph., in considerable numbers, and a treatment was therefore required that could be applied to each car before it was unloaded. In preliminary tests in a small vault, high mortality of larvae of *Pyrausta nubilalis*, Hb., buried in bales of broom corn was given by atmospheric fumigation with methyl bromide at rates of 1½–2½ lb. per 1,000 cu. ft. for four hours at 60°F. The fumigant was circulated by means of a small fan for 5 minutes at the beginning of each test. Many larvae survived the treatment, but died subsequently without further development, though in some cases they remained alive for many weeks.

In view of these promising results, a request was made that all broom corn be transported in refrigerator or steel box cars, which are suitable for fumigation, and this was done during the warm months of 1941. The fully loaded cars were fumigated late in the afternoon and were opened after an exposure of 16–18

hours, the temperature in the bales varying from 65 to 85°F. A dosage of 2 lb. per 1,000 cu. ft. space gave complete mortality of all insects present in the bales and cars and of test larvae of *Pyrausta nubilalis* and adults of *Calandra* (*Sitophilus*) *granaria*, L., introduced into the bales ; under the best conditions, 1½ lb. was also adequate, but 1 lb. was not. Before treatment, the drains from the ice bunkers of the refrigerator cars were blocked with moist paper and the doors of the steel box cars were sealed with masking tape or brown paper and paste ; where even slight leakages occurred, good mortality of insects in the bales was not obtained, although those free in the cars were killed. The fumigant was introduced by means of a straight copper tube 10 ft. long that penetrated well into the car and was quickly withdrawn after the application of the fumigant ; no fan was employed, since it was found that at the dosages used and at temperatures of 60°F. and more adsorption by the broom corn was not sufficient to prevent an even distribution of the gas.

During the autumn and winter of 1941–42, imported broom corn was subjected to vacuum fumigation with methyl bromide. The treatment was carried out in a vault of 1,200 cu. ft. capacity, capable of holding 20 bales, and test insects comprising locally-collected larvae of *P. nubilalis* and adults of *C. granaria* were placed in the bales. In the autumn, when temperatures varied from 60 to 70°F. in the bales and 75 to 85°F. in the vault, two hours' exposure to 2½ lb. methyl bromide per 1,000 cu. ft. in a sustained vacuum of not less than 2 ins. absolute mercury pressure gave complete mortality. As the weather became colder, the larvae, which were stored out of doors until required for fumigation, became more resistant and the proportion that did not succumb immediately was increased, though none survived to reach the pupal stage. At temperatures below 60°F., some of the weevils near the centre of the bales survived the treatment, and a margin of safety was therefore provided by increasing the exposure to 2½ hours, which gave complete mortality of larvae and weevils at temperatures of 60°F. amd more. Experiments indicated that there is no risk from the methyl bromide to persons handling the treated bales provided that the normal air-washing routine is followed and continuous ventilation is provided for 24 hours after the bales are placed in storage.

Green peas are frequently brought from the Gaspé coast to Montreal by express without being refrigerated and they sometimes contain larvae of *Cydia* (*Laspeyresia*) *nigricana*, Steph., in fairly large numbers. Experiments showed that complete mortality of these larvae is given by fumigating the packed hampers with methyl bromide for two hours at a dosage of 1½–1¾ lb. per 1,000 cu. ft. Under practical conditions, exposure for two hours to 2 lb. per 1,000 cu. ft. in atmospheric vaults or air-tight box or refrigerator cars at normal summer temperatures is recommended ; some initial circulation of the fumigant and adequate ventilation after treatment are necessary. The peas were not harmed by the fumigation.

The amount of non-volatile bromide residue left on fumigated dried peas and the effect of this on their subsequent germination were investigated in 1941. The schedules recommended against the pea Bruchid [*Bruchus pisorum*, L.] were employed, although the peas were not infested ; these comprised exposure to 2½ lb. per 1,000 cu. ft. space for two hours in a sustained vacuum of 2 ins. absolute mercury pressure and to 1½ or 2 lb. for 16 hours at atmospheric pressure. Germination was not impaired, and the non-volatile bromide residues were not sufficiently great to constitute a risk to consumers.

Entomology and Limnology.—*54th Rep. Cornell agric. Exp. Sta. 1941* pp. 127–138. Ithaca, N.Y., 1942. [Recd. November 1943.]

H. H. Schwardt, C. V. Lincoln, T. W. Kerr jr., & W. D. Wylie report that the predominant species among 100,000 June beetles collected in New York State in May and June 1940, when there was a considerable flight, were *Lachnosterna*

(*Phyllophaga*) *anxia*, Lec., and *L.* (*P.*) *fusca*, Froel., which were approximately equal in abundance, and *L.* (*P.*) *rugosa*, Melsh., and *L.* (*P.*) *hirticula*, Knoch, which were locally predominant. Experimental plots of grass and leguminous plants that were planted in 1939 became heavily infested in 1940, and in July and August the larval population over the whole area was found to be nearly 500,000 per acre ; there was no significant difference in population between plots of grass and leguminous plants.

Schwardt & M. Ramsay state that significant increases in the yield of field beans were obtained by dusting with Alorco cryolite, a mixture of copper arsenate and lime (1 : 4) or a dust containing 0·75 per cent. rotenone against the Mexican bean beetle [*Epilachna varivestis*, Muls.] ; provided that infestation is sufficiently high, significant increases in yield may be expected if 50 per cent. of the larvae are killed. Mixtures of 1 part calcium arsenate, copper arsenate or magnesium arsenate with 4 parts lime destroyed 50, 51 and 23 per cent. of the larvae, respectively. Schwardt further states that *Hylemyia cilicrura*, Rond., which is a major pest of field beans in most parts of New York State, can be partly controlled by delaying planting until the first-generation adults are numerous, but that this increases the risk of frost injury at the end of the season. Observations on the abundance of the various stages were made between 7th and 25th June 1940 in plots of beans sown on various dates between 27th May and 15th June. When 85 per cent. of the first-generation larvae had pupated, sowing was recommended and many growers who followed this advice escaped serious loss.

Schwardt, Lincoln & L. D. Newsom report that the most promising soil fumigant tested against the larvae and adults of the alfalfa weevil [*Otiorrynchus ligustici*, L.] in 1940 was an emulsion of 150 cc. methyl bromide, 140 cc. dichloroethyl ether and 4½ gm. Areskelene in 10 U.S. gals. water, which was sufficient to treat an area of 100 sq. ft. It was poured over the surface of the soil and followed by copious watering. Lincoln also describes observations on *Hylastes* (*Hylastinus*) *obscurus*, Marsh., on clover. Adults were collected on screens covered with adhesive from 22nd May to 5th August, most of them being caught during the first two weeks. Examination of the roots of red clover showed that new tunnels were first made in early June, and that their numbers increased considerably towards the end of July. Eggs were most abundant from mid-June until mid-August, and larvae were first found on 22nd June ; they were present throughout the season, and some overwintered in the roots. Pupae were not observed until 31st August, but newly-emerged adults had been seen on the previous day, and the pupae must therefore have been present for at least a fortnight. Infestation of red clover grown from seed obtained from 15 different sources varied from 13 to 50 per cent., and the differences were not due entirely to root size ; alsike clover [*Trifolium hybridum*] was only slightly infested and ladino clover [*Trifolium repens latum*] not at all.

C. E. Palm & Wylie summarise the results of laboratory tests with baits against larvae of *Cirphis* (*Leucania*) *unipuncta*, Haw., *Agrotis ypsilon*, Hfn., *Peridroma saucia*, Hb. (*margaritosa*, Haw.), *Amathes* (*Graphiphora*) *c-nigrum*, L., and *Feltia ducens*, Wlk. The most effective was a mixture of 2 or 3 lb. sodium fluosilicate and 100 lb. bran. Other poisons tested, in order of decreasing effectiveness, were sodium arsenite, arsenious oxide (white arsenic) and Paris green ; lead arsenate and calcium arsenate were unsatisfactory. The addition of blackstrap molasses to the bait was desirable.

D. L. Collins, D. Connola & L. E. Hagmann state that studies on the transmission of the fungus [*Ceratostomella ulmi*] causing Dutch elm disease have shown that the activities of *Scolytus multistriatus*, Marsh., in the trunks and larger limbs of living trees are responsible for more infection than was originally believed. *Hylastes rufipes*, Eichh., was associated with most of the diseased trees in two counties, and was found for the first time to feed fairly commonly in branches less than 1 in. in diameter. The importance of destroying or

treating dead elm wood was emphasised by the discovery of infected beetles in 38 per cent. of the samples collected over an area of 3,000 square miles. Mites may spread the fungus among stored logs, since they were found to transmit it from beetle galleries in diseased wood to uninfected galleries in healthy wood [*cf.* *R.A.E.*, A **25** 290, etc.].

T. C. Watkins & W. H. Ewart found that the onion thrips [*Thrips tabaci*, Lind.] can be controlled on onions by a spray containing 1 lb. tartar emetic and 4 lb. sugar in 100 U.S. gals. water ; no benefit was gained by the addition of wetting or spreading agents. The thrips appeared to increase on plants that were deficient in calcium and to decrease on those deficient in nitrogen. They also state that cloth-covered cages erected over weeds in mid-April, during studies on the control of lettuce yellows [*Chlorogenus callistephi* var. *vulgaris* of Holmes] by that of the aster leaf-hopper [*Macrosteles divisus*, Uhl.], were found in July to contain this Jassid, which had evidently survived the winter there.

W. A. Rawlins & R. E. Olson report that newly-hatched larvae of *Pheletes* (*Limonius*) *ectypus*, Say, can be destroyed in potato fields and reinfestation prevented by clean cultivation, provided that the fields remain fallow until late July. Late planted potatoes were again less severely injured than those planted early in the year [*cf.* **29** 643] ; the larvae cease feeding about 1st September, and late-planted tubers are therefore not exposed to them for so long as the early ones. The numbers of larvae were increasingly great in fields of winter wheat, field maize, lucerne, a mixed stand of clover and timothy grass [*Phleum pratense*], field beans, potatoes, oats and sweet clover [*Melilotus*], in that order, and ranged from 6·6 per 10 sq. ft. in the first to 91 in the last.

Rawlins, Watkins & J. O. Nottingham found that *Macrosiphum solanifolii*, Ashm., and *Epitrix cucumeris*, Harr., were the only important insect pests of potato in Long Island during 1940. A spray containing nicotine sulphate and vaporised nicotine both gave high Aphid mortality and significant increases in yield, but sprays containing ground cubé root or rotenone extract were less effective. The best results were obtained when the insecticides were applied before or at the peak of infestation ; when they were applied later, the increase in yield was not sufficient to offset the cost. Cubé dusts (0·75 per cent. rotenone) were effective against both species, but pyrethrum dusts were definitely less so and gave inconsistent results. Evidence in two consecutive seasons indicated that increases in Aphid populations on plants sprayed with Bordeaux mixture are responsible for the decreased yields given by such plants. No increase in fecundity was noted in caged Aphids fed on foliage sprayed with Bordeaux mixture, red copper oxide [cuprous oxide], calcium arsenate, wettable sulphur or hydrated lime.

Rawlins & W. E. Curtis report that when nymphs of the potato leafhopper [*Empoasca fabae*, Harr.] were confined to one of a pair of opposite potato leaflets and the other was used as a control, it was found that their feeding reduced photosynthesis in the leaf and also retarded the translocation of sap by disrupting the conducting tissue. Hopperburn is not always evident on injured leaflets. Both adults and nymphs stunt the foliage and cause it to curl. Rawlins & R. Staples state that *Epitrix cucumeris* was very abundant in many potato-growing regions, and that heavy infestations during a drought in August caused severe damage and loss. Sprays of Bordeaux mixture applied against *E. cucumeris* and *Empoasca fabae* from the time when the tubers were setting until the plants showed signs of maturity increased the yield to a greater extent than when they were applied earlier or later. When *Epitrix* was abundant, Bordeaux mixture containing 4 or 8 lb. lime with 4 lb. copper sulphate per 50 U.S. gals. gave better control and greater increase in yield than that containing 2 lb. lime ; both control and yield were further increased when pyrethrum or rotenone powder was added.

T. R. Hansberry & L. B. Norton give the results of various investigations on nicotine compounds [**30** 350, 351 ; **31** 339], including some on their toxicity as contact insecticides. Compounds of nicotine with fatty or naphthenic acids had a greater contact toxicity than those with casein, alginic acid, pectic acid, Aresket, sulphuric acid and alkyl halides and dialkyl dihalides. The high toxicity of the first group is attributed to their excellent wetting and spreading properties, the toxicity of the acid part of the compound, and an unknown synergistic effect of this part with the nicotine. Indications have been obtained that the rapid loss of nicotine from supposedly non-volatile compounds may be due to decomposition by light.

Hansberry, Palm & G. E. Carman report that oil-impregnated sulphur dusts containing dinitro compounds were ineffective against the eggs of the fruit-tree leaf roller [*Tortrix argyrospila*, Wlk.] and the apple red bug [*Lygidea mendax*, Reut.] on dormant apple trees. About 75 per cent. control of the overwintering larvae of the apple bud moth [*Spilonota ocellana*, Schiff.] was given by a dust of sulphur and Elgetol [containing sodium dinitro-ortho-cresylate] applied at the green-tip stage ; other dusts applied to apple during the dormant and green-tip stages were ineffective, but none injured the trees. The effectiveness of dusts applied in calyx or cover applications against the codling moth [*Cydia pomonella*, L.] was increased by the addition of 15 per cent. pastry flour, 3 per cent. insoluble soap (1·6 per cent. sodium oleate and 1·4 per cent. ferrous sulphate), 3 per cent. blood albumin or 1 per cent. mineral oil (though the percentage of oil should be reduced to 0·5 or 0·75 to prevent impairment of dusting properties), and the use of these stickers in dusts of lead arsenate and sulphur improved the control of apple scab on the fruits. Arsenates of lead, zinc and calcium were about equally effective in sulphur dusts, but the last caused severe scorching. With the exception of 3 per cent. nicotine, sprays were more effective than dusts in preventing superficial injuries.

Jenkins (L.) & others. **Codling Moth Control.**—*Bull. Mo. agric. Exp. Sta.* no. 459, 18 pp., 4 figs. Columbia, Mo., 1942. [Recd. November 1943.]

Notes are given on the life-history of the codling moth [*Cydia pomonella*, L.] on apple in Missouri, where it now has three complete generations a year, as compared with two and a partial third some years ago, and recommendations based on recent work there are made for improving the control obtained by growers. No satisfactory substitute has been found for lead arsenate in sprays, and if a normal spray schedule timed according to moth emergence does not give a sufficiently high percentage of undamaged fruit, it is considered better to apply supplementary measures of control [*cf. R.A.E.*, A **31** 462–463] than to increase the spray schedule. The effectiveness of lead-arsenate sprays is increased by the addition of deposit builders or stickers, such as summer oil [*cf.* **24** 318], and if facilities for the removal of spray residues from the fruit are not available, sprays of fixed nicotine may be substituted for lead arsenate after the second or third cover spray. Programmes for the treatment of heavily infested mature orchards and lightly infested orchards are included.

Smith (L. M.) & Ferris (C. A.). **New Materials for Control of the Mealy Plum Aphid.**—*Bull. Calif. agric. Exp. Sta.* no. 671, 30 pp., 2 figs., 6 refs. Berkeley, Calif., 1942. [Recd. November 1943.]

The results are given of tests carried out in California in 1937–40 with substitutes for coal-tar distillates as ovicides against *Hyalopterus arundinis*, F.

(*pruni*, F.) on plums and prunes [*cf. R.A.E.*, A **26** 62]. Treatments were applied when the trees were dormant; all dosages are given as concentrations per 100 U.S. gals. water. In preliminary tests, sprays of dinitro-ortho-cyclohexylphenol and its sodium salt, applied on 24th February 1938, were very effective, most of them surpassing tar distillates, but injured the cover crop; the best results were given by 4 oz. dinitro-o-cyclohexylphenol with 6 oz. caustic soda or by 2½ U.S. gals. of a proprietary solution of 4 per cent. dinitro-o-cyclohexylphenol in dormant-grade, eastern, paraffin-base oil; phenothiazine and ortho-nitrophenol in an emulsive dormant oil were ineffective.

In more comprehensive experiments in several orchards, 2, 1 and 0·5 U.S. gals. of the proprietary solution [9·6, 4·8 and 2·4 oz. of the phenol] gave 92–98, 72–81 and 32–70 per cent. control, respectively. There was no consistent difference in effectiveness when the phenol was used in eastern, paraffin-base oils or in western, asphalt-base ones. When it was applied in water without oil, 2 oz. gave 41–64 per cent. control and 4 oz. gave 71–89 per cent. The addition of a small quantity of acid to the water had practically no effect on toxicity, but an alkali increased control. The proprietary solution was most effective in untreated water and least in acidified water. In limited tests, the addition of 2 and 4 oz. dinitro-o-cyclohexylphenol powder to a 2 per cent. tank-mixed oil emulsion resulted in 53·9 and 73·9 per cent. control, respectively, indicating that under certain conditions good results may be obtained by this method. A proprietary solution and suspension of sodium dinitro-ortho-cresylate in water with 10 per cent. wetting agent gave 96–100 per cent. control when used at a rate corresponding to 12 oz. dry cresylate. Comparison of this with mixtures containing 5 per cent. wetting agent or none showed that the effectiveness of the chemical was decreased by the wetting agent, though at dosages above 12 oz. the differences in control were insignificant. When the proprietary mixture was added in the spray tank to an emulsion of petroleum oil and water with 4 oz. blood albumin spreader as emulsifying agent, no effect of the oil could be measured when 4 oz. cresylate was used (no control) or 12 oz. (94–100 per cent. control), but the addition of 1, 1·5 and 2 U.S. gals. oil reduced the control given by 8 oz. from 91 to 46, 75 and 88 per cent., respectively, in one orchard. The results obtained from a number of applications made a few hours before rain fell showed that though high concentrations of the cresylate are less affected by rain than lower ones, the spray must dry on the trees if control is to be satisfactory. A 20 per cent. solution of sodium dinitrophenolate was markedly inferior to sodium dinitro-o-cresylate. In limited tests, 1 U.S. pint of a triethanolamine salt of dinitro-o-cyclohexylphenol gave almost complete control of a light infestation under good spraying conditions; 2,4-dinitrophenol dissolved in oil was less effective.

One U.S. gal. of the proprietary solution of dinitro-o-cyclohexylphenol in oil gave 97 per cent. control of the Coccid, *Lecanium corni*, Bch., and 4 oz. of the same chemical with 2 U.S. gals. oil gave 97·3 per cent. control, which was reduced by the addition of either acid or alkali, but 2 and 4 oz. without oil were unsatisfactory (0–38 per cent. control) whether the water was treated or not; and 12 oz. dry sodium dinitro-o-cresylate gave only about 60 per cent. control, but the same concentration with 2 U.S. gals. oil gave 99 per cent. Neither of these compounds was effective against *Epidiaspis leperii*, Sign. (*Diaspis piricola*, Del G.), but they may give indirect control by depriving it of the lichens and algae that are its natural cover. Both injured the cover crops. No damage was caused to the trees by any dormant application, but severe injury occurred when these compounds were applied to trees that were beginning to bloom. No injury was caused by the application of the cresylate in water on 28th November to six trees that had received only light rainfall during October and November and, in four cases, irrigation early in November, indicating that in years when autumn rainfall is light and the trees drop their leaves early, it may be possible to spray before the cover-crop seeds have germinated.

Yust (H. R.), Nelson (H. D.) & Busbey (R. L.). **Resistance of the California Red Scale to Fumigation with Hydrocyanic Acid.**—*Calif. Citrogr.* **28** no. 8 pp. 207, 210. Los Angeles, Calif., 1943.

In order to ascertain whether differences in the resistance to hydrocyanic acid gas of the California red scale [*Aonidiella aurantii*, Mask.] on *Citrus* are the result of local differences in environment or of differences in the insects themselves, resistant and non-resistant stocks from different areas in California have been maintained in the laboratory under identical conditions since 1935. Their relative susceptibility has not changed during that period. To measure the variations in inherent susceptibility within a limited area, stocks obtained in 1940 from seven groves in the San Fernando valley, six of which were within an area two miles square, were reared under identical conditions in the laboratory. When the Coccids were fumigated in the second moult with hydrocyanic acid gas at a low dosage, the percentages that survived varied from 12 to 84, while those among individuals of the resistant and non-resistant strains that had been maintained since 1935 were 66 and 1, respectively. Mature females from the different stocks showed the same relative susceptibility, and less extensive tests showed that similar differences existed among groves in two other districts. In general, the stocks showing the highest survival rates originated from groves in which less frequent treatment had been adequate. It is concluded that the relative resistance of a population is the most important factor determining the degree of control.

It appears probable that both strains are present in any one grove and that successive fumigations therefore tend to increase the proportion of the resistant strain by destroying more of the other. In tests, the percentage mortality in a comparatively non-resistant stock that was subjected in the second moult to repeated fumigations at concentrations that killed about 50 per cent. was reduced to 67, as compared with 94 among examples from the same grove that had not been so treated. Since in these tests several fumigations took place in the course of a year, each before the females were fertilised, and the gas was evenly distributed, it is considered that resistance of the population was built up more quickly than it would be in the field, where treatment is less frequent, surviving females may have been fertilised by non-resistant males, and the concentration of the gas is variable.

Cressman (A. W.). **Effectiveness against the California Red Scale of Cube Resins and Nicotine in Petroleum Spray Oil.**—*J. agric. Res.* **67** no. 1 pp. 17–26, 1 graph, 11 refs. Washington, D.C., 1943.

An account is given of field experiments carried out in California in 1938 to determine whether the control of *Aonidiella aurantii*, Mask., on lemon by a spray of heavy petroleum oil (the specifications of which are given) could be improved by the addition of cubé resins or nicotine. The cubé resins contained 22·3 per cent. rotenone and were dissolved in an intermediary solvent consisting of trichlorethylene and dibutyl phthalate (1 : 2 by volume) [*cf. R.A.E.*, A **30** 439], and one part of the solution was added to nine of oil before emulsification, after which the resins were present partly in solution and partly in suspension in the oil. The mixture of trichlorethylene and dibutyl phthalate was also included in the oil in all the other sprays. The nicotine was added to the spray mixture when the tank was filled. Sprays containing 1 per cent. oil, alone and with 0·05 per cent. nicotine or 0·02 per cent. cubé resins, applied on 21st April, gave 61·3, 90·4 and 93 per cent. mortality of females in the late grey adult and later stages on the fruit and 24·7, 36·8 and 61·1 per cent. on the wood. When applied in October, similar sprays containing 2 per cent. oil, alone and with 0·07 per cent. nicotine or 0·025 per cent. cubé resins, gave 94, 99·2 and 100

per cent. mortality on leaves and 71·1, 87·5 and 96 per cent. on wood, and others containing 1·5 per cent. oil alone and with 0·025 per cent. cubé resins gave 75·5 and 95·5 per cent. on wood.

It is concluded that both nicotine and cubé increased the toxicity of oil to scales on all parts of the tree, the cubé resins being the more effective against scales on the wood at lower dosages of oil and on all parts of the tree when 2 per cent. oil was used. Spray mortality varied inversely with the density of infestation, except in cases of very high mortality, where an effect of population density was not always evident, and survival was highest on the heavily infested older wood. There was no evidence of injury to the trees due to the added toxicants.

Cressman (A. W.). **Effectiveness against the California Red Scale of Cube Resins in light-medium and heavy Spray Oils.**—*J. agric. Res.* **66** no. 11 pp. 413–419, 1 fig., 8 refs. Washington, D.C., 1943.

In further experiments [*cf.* preceding abstract], the effect of adding cubé resins to a light-medium as well as a heavy spray oil against *Aonidiella aurantii*, Mask., on lemon, was tested in the field and laboratory. The specifications of the two oils used are given. The same intermediary solvent was used for the cubé resins, which contained 22·3 per cent. rotenone in the field tests and 27·4 per cent. in the laboratory ones. In the field experiments, sprays containing 1·5 per cent. heavy oil, alone and with 0·025 per cent. cubé resins, gave 75·5 and 95·5 per cent. mortality, respectively, of females in the late grey adult and later stages on the wood and 88·3 and 95·4 per cent. on the fruits, and similar sprays of light-medium oil alone or with cubé gave 66·9 and 96·6 per cent. mortality on the wood and 82·5 and 97·3 per cent. on the fruits.

In the laboratory, sprays containing 1·5 per cent. heavy oil alone and with 0·02 per cent. cubé resins, and the same quantity of light-medium oil alone and with cubé resins, applied to lemon fruits on 27th January, gave 76·3, 98·6, 55·4 and 99·2 per cent. mortality of females in the same stages and similar sprays in which the concentrations of oil and resins were reduced to 1 and 0·017 per cent., respectively, applied on 15th March, gave approximately 61·7, 93·4, 57·4 and 98 per cent. mortality.

It is considered that the greater effectiveness of cubé resins in the lighter oil may be due to the fact that more of the light-medium oil penetrated beneath the scale covering, resulting in a higher dosage of cubé per scale ; that it reached the insect more quickly, decreasing the loss of toxicity of the cubé due to exposure to light and air ; or that the toxic principles of the resins are more soluble in the particular light-medium oil used.

Noble (W. B.) & Suneson (C. A.). **Differentiation of the two genetic Factors for Resistance to the Hessian Fly in Dawson Wheat.**—*J. agric. Res.* **67** no. 1 pp. 27–32, 2 refs. Washington, D.C., 1943.

The following is based on the authors' summary. An account is given of investigations in California on the resistance of Dawson wheat to *Mayetiola* (*Phytophaga*) *destructor*, Say, carried out with material derived from the cross Dawson × Poso and advanced towards the commercial type by different numbers of backcrosses to Poso. Selections having different genetic constitutions were isolated, and their performance during several years was recorded. They were then recombined and the progeny catalogued for reaction to *M. destructor* in F_2 and F_3 generations. In addition to confirming the presence of two factors for resistance to *M. destructor* [*cf. R.A.E.*, A **24** 615], the data demonstrate the successful isolation, differentiation and recombination of the

two Dawson factors. They further demonstrate the successful determination of these resistance factors in two additional backcrosses during a time of relatively low infestation.

Finally, the performance of the experimental variety Big Club 38, composed of F_3 lines selected from the third backcross of Dawson × Big Club to Big Club, over a four-year period demonstrates the successful application of the breeding method for control of *M. destructor*.

Hamlin (J. C.), McDuffie (W. C.), Lieberman (F. V.) & Bunn (R. W.). **Prevention and Control of Alfalfa Weevil Damage.**—*Fmrs' Bull. U.S. Dep. Agric.* no. 1930, 13 pp., 11 figs., 2 refs. Washington, D.C., 1943.

In this bulletin, which supersedes one already noticed [*R.A.E.*, A **16** 33], it is stated that economic damage by *Hypera variabilis*, Hbst. (*postica*, Gylh.) in the United States has been confined to lucerne and restricted chiefly to Utah, Nevada, Idaho, Colorado and Oregon [*cf.* **31** 512], where the weevil is the major insect pest of this crop and frequently causes important losses. The eggs are laid in clusters of 2–25 or more, inside hollow stems of lucerne, grass or weeds, in litter lying on the surface of the soil early in the season and in growing plants later. The young larvae feed within the growing tips of the lucerne and the larger ones on the upper opened leaves. When full-fed, they spin cocoons, usually near the base of lucerne plants, and the adults emerge 1–2 weeks later. Adults develop in summer from larvae living on the first and second crops. Many are carried to haystacks at harvest, where few of them survive, and large numbers migrate to ditch banks and the borders of fields, where they overwinter and do not become sexually mature until the following spring ; but the majority remain in lucerne fields, and some of the females mate and oviposit as long as the weather is favourable in autumn and again in the following spring [*cf.* **26** 326]. Eggs laid in autumn do not hatch until spring. Oviposition is greatest when the temperature at the crowns of the plants rises above 50°F. during the day and falls below that at night, and as these conditions are not the most favourable for hatching, large numbers of eggs accumulate and hatch rapidly when favourable temperatures occur.

The introduced parasite, *Bathyplectes curculionis*, Thoms., does not itself give complete control but makes cultural control possible. A parasitised larva continues feeding, though it consumes less than a healthy one, and is killed after it has spun its cocoon. The parasite overwinters as a larva in a cocoon within that of its host, and the adult emerges in the following spring when the weevil larvae are feeding on the lucerne. The earliest weevil larvae are nearly all attacked, and though the number of unparasitised ones gradually increases, 80–90 per cent. are parasitised when the first crop reaches the flower-bud stage of growth, usually late in May or early in June in the lower valleys and 2–3 weeks later in higher valleys of the Great Basin. At this time, most of the overwintered weevils have died and the remainder have almost exhausted their capacity for oviposition, most of the larvae are still immature and only a few cocoons, spun by the earliest larvae and most of them containing parasites, are present. Immediate harvesting of the first crop, if the weather is favourable, destroys nearly all the immature forms by starvation or exposure to heat, usually before severe damage has occurred, and so prevents the development of adults. Larvae on the second crop are too scarce to be injurious, but are not highly parasitised and so give rise to most of the adults that will overwinter. Early cutting of the second crop, 35–40 days after the first harvest, is rarely necessary to prevent injury, but is essential in order to restrict the number of weevils of the next generation. In areas where the weevil is not a serious pest, early cutting is not advisable, but in infested areas it should be carried out every year, even when the crops are not actually being injured, as otherwise enough weevils may be produced for damage to be caused in the following year.

The fields should be mown closely, the hay removed as soon as it is ready and the field surface kept as dry as possible for a week before cutting and for 7–10 days after.

Where the climatic conditions of the area, seasonal weather or other factors make early cutting impracticable, insecticides should be applied if damage is likely. Dusting with 2 lb. calcium arsenate per acre, mixed with an equal quantity of dusting sulphur, or spraying with the same quantity in 100 U.S. gals. water, reduces the number of larvae and prevents further damage until the crop can be harvested. Only one treatment of the first crop, as soon as the upper leaves have become noticeably ragged, is usually necessary ; the lucerne should not be harvested for at least 7–10 days to give the treatment time to be effective and reduce the arsenical residue on the hay. The treatment of the second crop as it approaches maturity is rarely necessary. No ill effects on livestock fed on lucerne treated in this way have been reported.

Few instances of retardation of the second crop have been observed in recent years, and in all of them the larvae on the first crop had not been controlled before the shoots of the second had appeared, with the result that they transferred their feeding to these. When this occurs, the best treatment is probably to keep the field dry and harrow it thoroughly to destroy young shoots, injure larvae and pupae and expose them to the sun. All stands should be maintained in vigorous growing condition, since this reduces the heat that penetrates to ground level and so retards oviposition, hatching and larval development and decreases the possibility that damage may develop before the first crop reaches the flower-bud stage. Ploughing out lucerne stands after 4–5 years, rotating with grain and cultivated crops for a few years and manuring the land result in profitable lucerne culture and also minimise weevil damage.

SEVERIN (H. H. P.). **Breaking in Color of Flowers of Annual Phlox caused by the Aster-yellows Virus.**—*Phytopathology* **33** no. 8 pp. 741–743, 1 fig. Lancaster, Pa., 1943.

In 1938, one plant of annual phlox (*Phlox drummondi*) was observed at Berkeley, California, showing breaking in colour of the flowers. Attempts to transmit the virus to healthy phlox by inoculation of juice failed. The virus was at first thought to be celery calico, which commonly induces breaking in pansies and violas in California, but breaking in phlox was not induced by inoculation of virus extract from various host plants of this virus and tests with its Aphid vectors also proved negative. Western cucumber mosaic, which occurs in the interior of California and causes breaking in the colour of pansies, violas, petunia and *Ranunculus*, was transmitted to phlox by inoculation of juice and by Aphids, but no breaking resulted, though the flowers of infected plants were dwarfed, with rolled petals, and sometimes the corollas were dead.

In 1941, many ornamental flowering plants grown commercially in the canyons of the Montara Mountains were affected by the Californian variety of aster yellows [*Chlorogenus callistephi* var. *californicus* of Holmes], and annual phlox showed both breaking in the petals and symptoms of aster yellows. In tests, the virus was transmitted from diseased phlox to healthy asters by the feeding of batches of 20 previously non-infective adults of *Macrosteles divisus*, Uhl., including the form with long elytra and the form with short ones [*cf. R.A.E.*, A **29** 302], and typical symptoms were produced. When lots of 20 males of *M. divisus* with short elytra that had completed their nymphal development on diseased celery and similar batches with long elytra that had developed on diseased asters were allowed to feed for three or more weeks on healthy phlox, which was then freed from them and kept in an insect-proof cage until blossoming time, the treated plants showed breaking in the petals, and the virus was recovered from them by Jassids with short and with long elytra and transmitted

to aster and celery, respectively. Males were used in these tests to avoid the deposition of eggs. The symptoms of breaking induced in phlox are described.

HAYWARD (K. J.). **El gusano chupador de la caña de azúcar** (*Diatraea saccharalis* (**Fabricius**)) **en Tucumán.**—*Bol. Estac. exp. agríc. Tucumán* no. 38, 25 pp., 17 figs., 10 refs. Tucumán, 1943 ; shorter version in *Rev. industr. agríc. Tucumán* **32** (1942) no. 10–12 pp. 315–325, 8 figs. Tucumán, 1943.

Diatraea saccharalis, F., is an important pest of sugar-cane in various parts of Argentina, including the Province of Tucumán, where it also infests maize, sorghum, rice and Guatemala grass (*Tripsacum laxum*). It attacks soft canes especially, but in their absence, or in heavy infestations, injury of almost the same intensity occurs in hard varieties. Descriptions are given of the injury done, of all stages of the moth and of its biology, and of the measures available against it. It has few natural enemies in Tucumán, and they are not very effective. The eggs are parasitised by two species of *Trichogramma* and one of *Telenomus* (*Prophanurus*) [*cf. R.A.E.*, A **16** 208], and the larvae by *Ipobracon tucumanus*, Brèth., *Microdus stigmaterus*, Cress. (*crossi*, Brèth.), *Theresia claripalpis*, Wulp (*Paratheresia signifera*, Tns.) and *Oxysarcodexia peltata*, Aldr. The last-named is itself parasitised by a Diapriid, *Aulatopria tucumana*, Brèth.

HAYWARD (K. J.). **La polilla taladradora de la caña de azúcar** (*Elasmopalpus lignosellus* (**Zeller**)).—*Bol. Estac. exp. agríc. Tucumán* no. 40, 9 pp., 6 figs., 11 refs. Tucumán, 1943 ; also in *Rev. industr. agríc. Tucumán* **32** (1942) no. 10–12 pp. 326–332, 6 figs., 11 refs. Tucumán, 1943.

Notes are given on the geographical distribution and bionomics of the Pyralid, *Elasmopalpus lignosellus*, Zell. Sugar-cane, the only cultivated plant on which it has been observed in Argentina, is attacked as soon as growth begins in spring. The only promising methods of control are clean cultivation and manuring to stimulate the growth of the plants.

HAYWARD (K. J.). **La oruga de la hoja del algodonero,** *Alabama argillacea* (**Hübner**) **en Tucumán.** [The Cotton Leaf Worm, *A. argillacea*, in Tucumán.]—*Bol. Estac. exp. agríc. Tucumán* no. 41, 21 pp., 16 figs., 10 refs. Tucumán, 1943.

Alabama argillacea, Hb., is one of the chief pests of cotton in the Province of Tucumán, Argentina. Its geographical distribution and bionomics are reviewed, and descriptions are given of all stages and the type of injury caused. In Tucumán, the larval stage lasts about 12 days and the pupal stage about 8, and there may be up to 5 generations a year. Lists are given of 15 Dipterous and 16 Hymenopterous parasites recorded from *A. argillacea* in the province, as well as formulae for preparing various arsenical sprays and dusts and instructions for their application. Traps baited with fruit pulp and juice poisoned with sodium fluosilicate, sodium fluoride or sodium arsenite may be used against the adults if they are injuring ripe fruit in orchards, but light and bait traps are not of much value otherwise.

D'ANGELO (W. A.). **Una mariposa dañina para el cultivo de las cucurbitáceas (zapallos),** *Melittia pulchripes d'angeloi*, **Khlr.** [A Moth harmful to Cucurbitaceae (Squashes).]—*Alm. Minist. Agric. Argent.* **18** pp. 149–152, 5 figs., 1 ref. Buenos Aires, 1943.

Squashes, which are an important crop in Corrientes, Argentina, are attacked by the larvae of *Melittia pulchripes d'angeloi*, Köhler, which make mines in the

roots and stems and often in the fruits, and pupate in the ground litter or just below the surface of the soil. The larva, pupa and adult of this Aegeriid are described. All infested plants should be burnt, the ground dug up to expose the pupae, and crop rotation practised.

PETTEY (F. W.). **How to make the best Use of *Cactoblastis* and Cochineal Insects.** —*Fmg in S. Afr.* 1941 repr. no. 28, 1 p. Pretoria, 1941. [Recd. December 1943.]

Cactoblastis [*cactorum*, Berg] has been widely distributed in South Africa for the destruction of prickly-pear [*Opuntia*] on farms [*cf. R.A.E.*, A **30** 31], but the author points out that colonies of this Pyralid increase at rates that vary with local conditions and may not produce much effect until three years after the eggs are put on the plants. There is a big reduction in the numbers of the insects when they have destroyed most of the succulent leaf-pads and are forced to subsist on the woody segments of the plants, followed by an increase as new leaf-pads grow. When the numbers become large enough, there is another heavy attack on these leaf-pads, followed by a reduction in insect population when they are destroyed. These waves of attack may be repeated at intervals of two or more years for a considerable time before the large plants are finally destroyed.

When *Cactoblastis* and cochineal insects [*Dactylopius*] have become well established on prickly-pear, the large plants become so weakened that they do not fruit or spread, and young ones are killed. The complete destruction of the plants is expedited if they are cut to within six inches of the ground after they have become heavily infested with one or both of these insects or after a considerable proportion of the leaf-pads have been destroyed ; the plants are then in such a weak state that most of them succumb completely to the shock of cutting and any regrowth that appears is weak and will be destroyed completely by the insects. When the plants have few or no low-lying branches and most of the succulent leaf-pads are high above the ground, they will be more readily destroyed if they are cut down before either of the insects becomes abundant. If *Cactoblastis* is present, the plants should be cut down only between mid-May and 1st September, in order to avoid knocking off egg-sticks that may be present during the rest of the year. If only *Dactylopius* is present, they may be cut down at any time.

THOMAS (P. H.). **Apricot Culture in Tasmania.**—*Tasm. J. Agric.* **14** no. 1 pp. 4–9, 3 figs. Hobart, 1943.

A very short section of this paper deals with insects that attack apricot in Tasmania, of which none is of constant occurrence. Old trees are sometimes infested by wood borers, particularly the Tineid, *Cryptophasa albicosta*, Lewin, the larvae of which should be killed in their burrows by means of flexible wire if infestation is serious. Melolonthid beetles have occasionally caused great damage ; in some districts, *Diphucephala colaspidoides*, Gylh., has completely defoliated orchards. Such attacks are usually localised and may be controlled with a lead-arsenate spray containing a casein spreader if the fruit is not mature.

MASSEE (A. M.). **Insect Pests of the Hop.**—*J. Inst. Brew.* **49** no. 3 pp. 136–139, 2 refs. London, 1943.

Most of the information in this paper on pests of hops in England has been noticed from another source [*R.A.E.*, A **31** 145], but it also includes notes

on *Forficula auricularia*, L., which caused severe damage in some places in 1942. The adults feed, mostly at night, on the young leaves and the growing tips of the bines, thus considerably checking growth, and shelter in crevices in the poles and under clods of earth during the day. As a result of heavy feeding the foliage becomes stunted and ragged. Attacks may occur at any time during the growing season, but they are most injurious at the end of May and in June. A spray of 8 oz. nicotine and 6 oz. spreader in 100 gals. water applied at a pressure of at least 300 lb. when the infestation is first noted and subsequently at intervals of 2–3 days is the best control measure ; sprays and dusts containing lead arsenate and derris were not satisfactory.

Some control of the hibernating larvae of *Contarinia humuli*, Tölg [*cf.* **31** 146] is given by a dressing of crude naphthalene broadcast over the soil at the rate of 4 cwt. per acre and lightly harrowed in after picking. All bines should be burned before the dressing is applied. If derris is unobtainable for the control of *Psylliodes attenuata*, Koch, adults of which emerge in September, slaked lime applied two or three times provides a good substitute. Jarring the bines so that the beetles fall on to tarred boards is satisfactory if repeated several times. Young hop sets in the nursery are often severely attacked, and special care should be taken to protect them.

Wilson (G. F.). **Potato Tuber Injury due to Soil Pests.**—*J. R. hort. Soc.* **68** pt. 7 pp. 206–214, 2 pls., 1 fig. London, 1943.

The author gives a popular account of the life-histories of a number of soil pests that attack potato tubers in England, particularly in newly ploughed grassland, with notes on their control. Attack by wireworms, which are the most common and widely distributed of these and are the most difficult to eradicate, is reduced by lifting the tubers by the end of August [*cf. R.A.E.*, A **28** 386], by regular cultivation [*cf.* **28** 157], by the use of traps of potato, carrot, beetroot or cabbage stalks, buried in the ground and examined periodically, and by the consolidation of the ground of seed beds, especially in light soils. The larvae of cockchafers, such as *Melolontha melolontha*, L. (*vulgaris*, F.), cause damage in light soil and in the neighbourhood of deciduous woods, particularly of oak, but it is not generally severe unless the ground is weedy and rough or has recently been converted from waste-land. The eggs are laid in the soil and the larvae are seldom injurious until they are two or three years old, when they burrow into the tubers and make large holes in which they feed. Handpicking the larvae when the ground is being trenched or dug can be practised in small areas, pigs and poultry should be allowed on the land during or immediately after ploughing or digging, and potato trenches may be dressed with 2 oz. per yard of flake or whizzed naphthalene in spring to kill the young larvae and repel the older ones ; winter treatment of light soils with crude naphthalene has little effect.

Tipulids are specially troublesome in converted grassland, but also occur in cultivated ground, particularly in the moister districts after a mild, wet autumn ; damp, sour and ill-drained soils tend to attract the flies and provide conditions favourable for oviposition. The larvae have a wide range of food-plants and feed both below ground and on the surface of the soil, burrowing into potato tubers and severing the base of the haulm. The adults occur in summer and early autumn, and the eggs are laid in the soil at the base of plants ; the larvae begin to feed as soon as they hatch and continue to do so throughout the winter and spring. The chief cultural control measures are providing effective drainage for moist soils, destroying all weeds and keeping the surface layers of soil disturbed by regular hoeing. Trapping by means of turves, partly buried grass-downwards in infested ground, is effective but troublesome, and

a moistened bait of 12 lb. bran and ½ lb. Paris green, broadcast evenly towards evening at the rate of ½–1 oz. per sq. yard [*cf.* **28** 386] affords the best direct control.

Of the two species of *Hepialus*, *H. lupulinus*, L., and *H. humuli*, L., that attack crops, the former is the more common in gardens and may injure potato tubers. The larvae often occur in large numbers in grassland and weedy places, feeding on roots and tunnelling into bulbs, corms and tubers, and migrate to potato crops from surrounding grassland, causing damage similar to that due to cockchafer grubs. The adults fly at dusk in June and July, the larval stage lasts two or three years and pupation occurs in the soil or in cavities in coarse roots and tubers. The larvae are sometimes destroyed by fungi, especially in damp soils. Digging and hoeing render conditions unfavourable to the larvae by injuring them, exposing them to birds and preventing the growth of coarse weeds. Larvae should be collected and destroyed when the ground is cultivated, and particular attention should be given to rough turf and neglected grass paths surrounding vegetable plots. Infested ground may be dressed with 2–3 oz. whizzed naphthalene per sq. yard, worked well into the soil during autumn or spring. The cutworms, *Agrotis* (*Euxoa*) *segetum*, Schiff., *A.* (*E.*) *exclamationis*, L., and *Triphaena* (*Graphiphora*) *pronuba*, L., which feed at night, often sever potato haulms and tunnel in shallow tubers. The adults are present from early June to late July, and the eggs are laid on leaves, grass stems and elsewhere. The larvae appear in about a fortnight and feed on various plants until August in some cases and the following spring in others, before pupating. Larvae of a second generation also feed in winter. Control measures comprise clean cultivation, hand-picking of larvae in the neighbourhood of wilted plants, allowing poultry free run of infested ground during digging and after lifting the crop, and the use of the poison bait recommended against Tipulids.

Millepedes, of which *Tachypodoiulus niger*, Leach, and *Blaniulus guttulatus*, Bosc, are widely distributed and often numerous in soils rich in organic matter, feed almost entirely on dead and decomposing vegetable matter, and frequently follow an attack of slugs, wireworms and other soil insects, penetrating into the borings and extending the initial injury. They are secondary pests, but, in soils containing a high population, feed on the skin of soft-skinned varieties of potato, causing injury that facilitates the invasion of bacteria and fungi so that speedy decay of the injured tissues follows. Infested ground should be given a heavy dressing of lime (10–12 oz. per sq. yard) in late autumn or winter, moist soils should be drained and the surface layers should be kept disturbed by regular hoeing and cultivation. In small areas, millepedes may be trapped by means of scooped-out potato tubers, or sliced mangels, swedes or carrots, buried below the surface of the soil and examined every 3–4 days. Crude naphthalene, thoroughly incorporated with the top 6–9 inches of soil at the rate of 3–4 oz. per sq. yard, acts as a temporary repellent and allows the plants to become established before they are damaged.

STEWART (R. P.). **A Modification of the Flea Beetle Trap.**—*J. R. hort. Soc.* **68** pt. 9 p. 275, 1 fig. London, 1943.

When the mobile trap for catching flea-beetles [*Phyllotreta* spp.] described by Fox Wilson [*R.A.E.*, A **31** 283] was tested in a turnip field, it was found that the sound, shadow or vibration of the apparatus disturbed the beetles before it reached them, so that the majority escaped. This was obviated by fixing two boards 6 ins. long and splayed outwards at an angle of 45° to the sloping side-boards to form a continuation projecting in front of the runners. When the modified trap was tested, large numbers of beetles were caught, 75 per cent. of them on the splayed pieces. The adhesive used was old engine oil.

WILSON (G. F.). **A Note on the Control of the Onion Fly,** *Delia antiqua.*—*J. R. hort. Soc.* **68** pt. 9 pp. 276–277, 1 pl., 1 fig. London, 1943.

The author points out that cultural methods that hasten the growth of onion plants early in the season are important for the control of *Hylemyia* (*Delia*) *antiqua*, Mg., and supplement the use of mercurous chloride (calomel) as a seed dressing or dust in districts where climate and soil are especially favourable to the insect. In trials at Wisley, Surrey, in 1942–43, infestation was concentrated on single bulbs or on groups of two or three neighbouring bulbs in rows of plants raised from seed sown in August 1942 and under glass on 1st March 1943, respectively, and 20 or more larvae occurred in a single bulb, whereas groups of as many as 20–30 plants were destroyed in rows sown in the open on 9th March 1943, since the individual plants were not large enough to provide sufficient food for the larvae, which accordingly migrated from plant to plant along the row. In the more mature plants, infestation can be detected, as the foliage first wilts and dies and the bulb then decays, whereas seedlings are destroyed outright. The application of quick-acting nitrogenous fertilisers is also beneficial in hastening growth.

CORBET (A. S.) & TAMS (W. H. T.). **Keys for the Identification of the Lepidoptera infesting stored Food Products.**—*Proc. zool. Soc. Lond.* (B) **113** pt. 3 pp. 55–148, 5 pls., 287 figs., 17 refs. London, 1943.

Keys to the adult moths of which the larvae infest stored products are preceded by a list of the included species in phylogenetic order, showing their synonymy, their distribution so far as this is known from material in the British Museum and authentic records, and the materials infested by the larvae. Some moths are included because it is strongly suspected that they may ultimately prove to be pests of stored products, and there are a few examples of groups of two or more species that have only recently been distinguished and occur together in the same geographical areas, some of which may not have been recorded as pests.

HINTON (H. E.). **The Larvae of the Lepidoptera associated with stored Products.** —*Bull. ent. Res.* **34** pt. 3 pp. 163–212, 128 figs., 18 refs. London, 1943.

In view of the inadequacy of the available descriptions of Lepidopterous larvae that attack stored products, the author provides keys based on the arrangement of the setae and other structural characters to 35 of some 70 species that have been found associated with them in various parts of the world. A general description is given of the larvae of each of the nine families included and more detailed descriptions of those of most of the species, with data on their distribution, based on authentic material in the British Museum. The larvae dealt with include all the more important British species and seven that have not been recorded in Britain.

JONES (M. G.). **A brown Aphis,** *Aphis* (*Doralis*) *cognatella*, **sp. n., found on Spindle Tree.**—*Bull. ent. Res.* **34** pt. 3 pp. 213–224, 4 figs., 7 refs. London, 1943.

The Aphid here described as *Aphis cognatella*, sp. n., occurs on *Euonymus* in East Anglia and North Wales and has been confused with *A. fabae*, Scop., of which *E. europaeus* is the chief winter food-plant. The apterous viviparae are described in detail and these and the fundatrices, alate viviparae, oviparae, males and eggs are compared in tables with those of *A. fabae* ; in addition, the apterous sexuparae are compared with the alate gynoparae of *A. fabae*. The biology of *A. cognatella*, which has been recorded only from *E. europaeus* and *E. hamiltonianus*, with the exception of one colony that was found on *Viburnum opulus* in Monmouthshire, is described. Unlike *A. fabae*, it does not migrate to

summer food-plants; the alates migrate to fresh bushes of *Euonymus* in June and the apterae from one part of the bush to another. Colonies were obtained on other food-plants in the laboratory by the transference of single apterous or alate viviparae; two or more generations were reared on *Chenopodium album*, *Rumex obtusifolius*, *Arctium lappa* and *Capsella bursa-pastoris* and one on *Papaver rhoeas* and beet, but reproduction did not take place on broad beans (*Vicia faba*) or *Cirsium arvense*, whereas *Aphis fabae* always produced large and flourishing colonies on all these plants. Under outdoor cage conditions, *A. cognatella* migrated from *Euonymus europaeus* to some of these plants, but most of the Aphids remained on the *Euonymus* and the colonies formed on the other plants consisted of only a few individuals. No colonies were found on beans bordered by heavily infested *Euonymus* in the open. Breeding experiments in which single apterous sexuparae were confined on twigs of *Euonymus* showed that both males and oviparae are produced by the same sexupara. The eggs are deposited at random on the internodes and nodes, and not concentrated chiefly in the axils of the buds, as are those of *A. fabae*.

Potter (C.) & Tattersfield (F.). **Ovicidal Properties of certain Insecticides of Plant Origin. (Nicotine, Pyrethrins, Derris Products.)**—*Bull. ent. Res.* **34** pt. 3 pp. 225–244, 3 figs., 15 refs. London, 1943.

The following is the authors' summary. The pyrethrins, nicotine, rotenone and a derris resin have been tested in the laboratory under standard conditions for their ovicidal effect. The test-subjects were: *Pieris brassicae*, L., *Plutella maculipennis*, Curt., *Aphis rhamni*, Boy., *Ephestia kuehniella*, Zell., and *Sitotroga cerealella*, Ol. Notes on the technique of egg production are given for these species. In the majority of the tests made, a water medium containing acetone together with sulphonated lorol as a wetting agent was used. It has been shown that all these products are toxic to the species on which they were tested. Lauryl thiocyanate, β-butoxy β′thiocyanodiethyl ether [butyl carbitol thiocyanate] and 3,5 dinitro-o-cresol were included as substances of recognised ovicidal value for purposes of comparison. All the above insecticides derived from plants compared favourably in their toxic action with the synthetics. In two instances during tests on eggs of *E. kuehniella*, data were obtained enabling a satisfactory statistical comparison of relative potency to be made. In the first of these, the pyrethrins were found to be $8{\cdot}45 \pm 1{\cdot}47$ times as toxic as 3,5 dinitro-o-cresol, while in the second the pyrethrins were found to be $2{\cdot}66 \pm 0{\cdot}26$ times as toxic as a *Derris elliptica* resin (rotenone content 37–40 per cent.). It therefore appears that both the pyrethrins and the derris resin were more toxic, weight for weight, than 3,5 dinitro-o-cresol, which is recognised as one of the most potent ovicides. The above vegetable poisons were found to be toxic not only to eggs developing in a few days without a diapause, but also to those of *Aphis rhamni*, a species of overwintering egg. The tests on *A. rhamni* were made at the time the eggs were just starting to hatch. The same result might not have been obtained with eggs at an earlier stage of development.

Observations were made on the effect of the different insecticides on the development of the egg. This effect appeared to differ with each substance, either qualitatively or quantitatively, but within the limits of the experiment it seemed to be independent of the species of the egg.

Ahlberg (O.). **Jordflyhärjningen i Västervikstrakten.** [The Cutworm Outbreak in the Västervik District.]—*Växtskyddsnotiser* 1943 no. 5 pp. 11–12. Stockholm, 1943.

Further examination of the cutworms that died within 12 days of dusting a plot of oats with the spores of *Metarrhizium* [*anisopliae*] in kieselguhr [*R.A.E.*, A **31** 427] showed that though they all contained hyphae of the fungus,

conidia were formed in very few cases. Bacteria were numerous in them and had apparently prevented the development of the fungus. Larvae that survived the treatment for more than a month showed no trace of fungous infection after death, but all contained bacteria. When the plot was examined at the beginning of July, no larvae or pupae could be found, and it is thought that this must have been due to the action of the bacteria, which thus terminated the outbreak. The cutworms could not be identified with certainty, but are thought to have been *Euxoa* (*Agrotis*) *nigricans*, L., and *E.* (*A.*) *tritici*, L.

KJELLANDER (E.). **Grönsaksflyet angriper växthustomater.** [*Polia oleracea* attacks Greenhouse Tomatos.]—*Växtskyddsnotiser* 1943 no. 5 pp. 15–16, 2 figs. Stockholm, 1943.

Polia oleracea, L., was first observed infesting tomatos in greenhouses in Sweden about 4–5 years ago, and caused serious crop losses, amounting in some cases to 50 per cent., in the summer and autumn of 1943. The larvae, pupae and adults are briefly described ; there are apparently at least two generations a year, though larvae are present throughout most of the season. They were first observed in January. Growers failed to obtain control by fumigation with nicotine or hydrocyanic acid gas ; a dust containing cryolite gave fairly good results, but the fruits must be wiped at harvest to free them from the residue. The adults can be prevented from entering the houses by the use of nets over windows, etc., where this is possible, and the pupae can be destroyed by steam-disinfestation of the soil, which is impracticable for many growers. Tests have shown that the larvae are killed by a spray containing about 1 per cent. nicotine with a spreader. Arsenicals are also effective, but should not be applied after the fruit has set.

CHEN (Fong-ge). **A preliminary Study on** *Citrus* **Cerambycid,** *Nadezhdiella cantori* **(Hope).** [*In Chinese.*]—36 pp., 2 pls., 2 graphs, 13 refs. [Chengtu] Szechwan agric Res. Sta., 1942. (With a Summary in English.) [Recd. December 1943.]

Longicorns, particularly *Nadezhdiella cantori*, Hope, are the most serious insect pests of *Citrus* in the province of Szechwan ; this Cerambycid attacks all the species grown and is considered to cause an annual loss of about 10 per cent. of the crop. Investigations carried out in 1938–40 showed that its life-cycle lasts approximately two years and that the adults are active at night. Oviposition takes place from May to July, principally in late May and early June, and the eggs are usually deposited in cracks and crevices of the bark of the trunk within three feet of the ground.

The best method of control is to prevent oviposition by covering the trunk with flat straw ropes or filling holes and cracks with concrete or an adhesive substance ; whitewashing the trunk was less effective. Other measures include removing the eggs and larvae from the trunk with a small knife or wire in late June or July and again in August, and collecting the adults on warm damp nights.

CRAWFORD (J. C.). **A new Genus and Species of Thysanoptera from New Zealand (Family Thripidae).**—*Proc. ent. Soc. Wash.* **45** no. 6 pp. 151–153, 1 fig., 1 ref. Washington, D.C., 1943.

Othinanaphothrips, gen. n., is erected for *O. spilleri*, sp. n. (the type) and *Hemianaphothrips tersus*, Morison, and *O. spilleri* is described from adults of both sexes taken on tobacco in a greenhouse at Auckland in 1941.

Gersdorff (W. A.). **Effect of Change of Temperature on relative Toxicity of Rotenone and Phenol.**—*J. agric. Res.* **67** no. 2 pp. 65–80, 4 figs., 11 refs. Washington, D.C., 1943.

The following is based on the author's summary and conclusions. The effect of temperature on apparent toxicity, when measured by the criterion of the minimal product of concentration and survival time, was studied with rotenone and phenol as the test materials and small goldfish (*Carassius auratus*) as the test animals. The experiments were carried out at temperatures ranging from 7 to 27°C. [44·6–80·6°F.] in increments of 5°C. [9°F.], and all results were subjected to statistical analysis.

In spite of the great dissimilarity in the mode of toxic action of rotenone and phenol, the relationship between increase in toxicity and increase in temperature was found to be the same for the two compounds; phenol was 0·16 per cent. as toxic as rotenone at any temperature in this range. The ratio of increase was found to be the same for equal increments in temperature (1·66 per increment of 5°C.), and an exponential equation connecting geometric increase of relative toxicity with arithmetic increase in temperature is given. Under the conditions of these tests, relative toxicity may be defined as a function of the nature of chemical compounds, and its values are not affected by change of temperature. Such a change influences only the physiological processes of the test animal, and the apparent effect on toxic action is a function of the animal's resistance. In this sense, toxicity and resistance have not a simple inverse relationship, but are distinct conceptions, the former inherent in the nature of the toxicant and the latter in the nature of the test animal.

Wilson (H. F.) & Campau (E. J.). **The Effect of Oil in Rotenone Dust Mixtures.**—*Soap* **19** no. 6 pp. 123, 125, 127. New York, N.Y., 1943.

In greenhouse tests carried out in Wisconsin between October 1942 and January 1943 with oil-conditioned dusts containing 0·1–0·75 per cent. rotenone for the control of the pea Aphid [*Macrosiphum onobrychis*, Boy.], increasing the oil content from 1 to 3 per cent. significantly improved control; the difference between dusts containing 2 and 3 per cent. oil was barely significant, but indicated that the higher concentration is generally the more effective, and the control given by mixtures containing 3 and 4 per cent. oil was not affected when propylene laurate or certain proprietary adjuvants were substituted for part of the oil. These dusts were prepared in May and June 1942, and comparison with similar freshly made ones in February 1943 showed that they had suffered some reduction in toxicity; reconditioning with 1 per cent. oil resulted in a recovery of toxicity in most cases. Two 1942 mixtures containing only 0·1 per cent. rotenone with 3 or 4 per cent. oil or its equivalent still showed fairly high toxicity in March (50 and 73 per cent. control before being reconditioned and 84 and 93 per cent. afterwards), and one 1940 dust containing 0·1 per cent. rotenone and 1 per cent. oil, though ineffective before being reconditioned, gave 57 per cent. control afterwards.

In field experiments, the results were masked in some tests by the high rates of application, but where 21–45 lb. per acre was used, increasing the oil content tended to give better control. It is considered that 30–35 lb. dust per acre is sufficient.

List of Intercepted Plant Pests, 1942.—*S.R.A., B.E.P.Q.* [1942] 41 pp. [Washington, D.C.] U.S. Dep. Agric., 1943.

This list of pests intercepted between 1st July 1941 and 30th June 1942 with plants or plant products entering United States territory (including Hawaii and Porto Rico) resembles previous ones [*R.A.E.*, A **30** 556; **31** 280] in the selection and arrangement of the data.

Service and Regulatory Announcements, October-December 1942.—*S.R.A., B.E.P.Q.* no. 153 pp. 73–95. [Washington, D.C.] U.S. Dep. Agric., 1943.

Announcements relating to Quarantine no. 72 against the white-fringed beetle [species of the subgenus *Graphognathus* of *Pantomorus*] extend the regulated area to include parts of three counties in North Carolina, where infestations were observed in 1942 [*cf. R.A.E.*, A **31** 257], and several additional areas in Alabama and Mississippi.

Other information in this part includes supplements to plant-quarantine import restrictions already noticed from Argentina and the Belgian Congo, and summaries of the current domestic and foreign plant quarantines applying to the United States and the Territories of Porto Rico and Hawaii, and other restrictive orders under the Plant Quarantine Act [**17** 163].

Service and Regulatory Announcements, April–June 1943.—*S.R.A., B.E.P.Q.* no. 155 pp. 17–24. Washington, D.C., U.S. Dep. Agric., 1943.

Announcements relating to potato regulations in the United States contain Amendment no. 4 to regulation no. 7 [*cf. R.A.E.*, A **11** 172] prohibiting the importation of potatoes from the State of Chihuahua, Mexico, where the potato weevil, *Epicaerus cognatus*, Sharp, now occurs. They may be imported under specified conditions from the State of Guanajuato, where the weevil has not been found, as well as the Northern Territory of Lower California.

King (K. M.) & McDonald (H.). **Control of the Red-backed Cutworm.**—[*Leafl.*] *Saskatoon Lab. Dep. Agric. Canada* no. 59, 4 pp., 1 fig., multigraph. [Ottawa] 1943.

In the parkland and wooded areas of Saskatchewan and the other Prairie Provinces, the red-backed cutworm [*Euxoa ochrogaster*, Gn.] is usually the chief spring species, and gardens are dangerously infested nearly every year. There are generally widespread outbreaks every few years, when field crops are heavily attacked; injury to sunflowers, flax, sugar-beet and sweet clover [*Melilotus*] is particularly severe, and maize, oats, barley, and occasionally wheat, may be seriously damaged. At such times, the larvae may be abundant far out on the open prairie, especially in gardens and in irrigated districts. Cutworms of other species, differing somewhat in appearance but similar in habits and means of control, are often associated with *E. ochrogaster*. One proper application of a poison bait consisting of 2 lb. Paris green, 3–4 lb. sodium fluosilicate or 3 lb. calcium arsenate with 100 lb. bran and 7–8 gals. water usually gives effective control, but a second application a few days later may be necessary. The bait should be scattered uniformly and thinly, preferably just before dark on a warm evening, the quantity given being sufficient for at least 5–10 acres. An annual application is advisable in gardens just before the first plants show. Crops should be treated as soon as damage is noticed in the field, and the bait should be applied where the cutworms are actually feeding. Early resowing when a crop has been severely damaged should be followed by an application of bait at the first favourable opportunity, but if the need for resowing is not evident until the cutworms are nearly full-grown, it should be deferred until most of them have ceased to feed, usually about 20th June. The moths oviposit in late summer and lay most of their eggs in soil that is loose and dusty, especially when it is loosened by a heavy growth of large weeds. Weeds in summer fallow should therefore be destroyed by the third week in July and the soil left undisturbed throughout August unless a rank weed growth begins, when it should be destroyed at once. Careful watch for infestation should be kept during the year after an outbreak.

Since the poison bait is seldom effective against the pale western cutworm [*Agrotis orthogonia*, Morr.] and ineffective against wireworms, methods of distinguishing these from *E. ochrogaster* are given.

Brown (A. W. A.). **Annual Report of the Forest Insect Survey, 1942.**—12 pp., 2 maps. Ottawa, Dep. Agric. Canada, 1943.

The area covered by the Forest Insect Survey in Canada was again extended [*cf. R.A.E.*, A **31** 133] during 1942 and the number of samples received increased to 13,210. Notes are given as in previous years on the incidence of upwards of 50 species of insects that attack forest trees, arranged according to their food-plants. In general there was a definite decrease in insect infestation, and this was most marked in the case of *Gilpinia hercyniae*, Htg., on spruce and *Pristiphora erichsoni*, Htg., on larch in eastern Canada. The single factor most concerned in the reduction of the former was the larval disease [*cf.* **30** 465], which now occurs throughout the infested area except in the extreme west; with the exception of a few areas of moderate abundance, infestation by this sawfly was light. Heavy infestation by *P. erichsoni* occurred over wide areas in Newfoundland, and its range in British Columbia was extended westward, isolated colonies occurring even in the Okanagan Valley.

Other insects of importance during the year were *Harmologa* (*Cacoecia*) *fumiferana*, Clem., on spruce [*cf.* **31** 348] and *Malacosoma disstria*, Hb., on poplar, both of which decreased slightly in numbers, the race of *H. fumiferana* that infests jack pine [*Pinus banksiana*], which increased slightly, and *Bucculatrix canadensisella*, Chamb., which was as injurious on birch as in the previous year [**31** 134]. The distribution of light, medium and heavy infestations of *H. fumiferana* on spruce in Ontario and Quebec and of *G. hercyniae* in these Provinces and in New Brunswick, Nova Scotia and Newfoundland is shown on maps. *Agrilus anxius*, Gory, and *Chermes* (*Adelges*) *abietis*, L., continued to be prevalent on birch and spruce, respectively, and adults of *Serica tristis*, Lec., which normally feed on birch and willow, attacked the needles on new shoots of white spruce [*Picea glauca*] in a plantation in Quebec where it caused considerable damage. A sudden, severe outbreak of *Paleacrita vernata*, Peck, occurred on sugar maple [*Acer saccharum*] in southern Ontario and eastern Quebec; several other Geometrids were associated with it, and one of them, *Alsophila pometaria*, Harr., was also abundant on Manitoba maple [*Acer negundo*] in Saskatchewan, Manitoba, Alberta and Nova Scotia.

An outbreak of *Dendroctonus monticolae*, Hopk., that began about 1929 in the Kootenay stands of lodgepole pine [*Pinus contorta*] was still active, and a report by G. R. Hopping is quoted in which he states that mortality among trees of 110–120 years of age, which up to 1938 was less than 10 per cent., had increased to 46–79 per cent. by 1941. *Ips latidens*, Lec., *I. interpunctus*, Eichh., and *I.* (*Pityogenes*) *knechteli*, Swaine, were also present in large numbers, attacking parts of trees damaged during the previous summer by *D. monticolae*. In 1942, their attack occurred in late May and early June. *D. monticolae* and *I. interpunctus* are confined mainly to the lower and *I. knechteli* to the upper third of the tree; *I. latidens* also attacks the upper part, but occurs on all parts of small trees. Mature trees are occasionally killed by *I. interpunctus* alone, and small trees by *I. knechteli*, but past experience indicated that none of these three species of *Ips* can occur in a widespread outbreak as a primary pest.

Fennah (R. G.). **Food-crop Pests Investigation. Windward and Leeward Islands. First Report. Report on Work during the Period April 1942–April 1943.**—16 pp., 7 figs., multigraph. Trinidad, Imp. Coll. trop. Agric., 1943.

In April 1942 the author began a series of investigations on the control of insect pests of food-crops in the Lesser Antilles and Trinidad and gives in this

paper the results of the first year's work, which included a survey of parasites. In introductory sections he reviews cultural factors affecting the production of food-crops and methods of establishing the plots so as to minimise losses due to various causes. Mole-crickets can be repelled by a seed dressing of 4 per cent. mercurous chloride (calomel) in flour, which may, however, seriously reduce germination ; 2 per cent. is still largely effective and comparatively safe. Seedlings can be protected from them by guards made of large, tough leaves or of bamboo sunk into the soil and by poison baits.

The young leaves of maize are attacked by *Laphygma frugiperda*, S. & A. [*cf. R.A.E.*, A **31** 258], and the percentage infestation averaged 53 in seven fields in Trinidad between May and November 1942. Arsenical sprays and dusts applied so that they reach the central whorl provide the best available control measure, but they did not prove particularly effective in tests and some of them scorched the plants. Prompt spraying or treating the whorls with a poison bait of maize meal and Paris green or lead arsenate (70 : 1) early in the season gave the most promising results. The parasites recorded from this Noctuid in the Lesser Antilles include a species of *Trichogramma* that attacks the eggs in Montserrat, and *Archytas piliventris*, Wulp, in St. Vincent [*cf. loc. cit.*]. *Euplectrus comstocki*, How., *Charops unicincta*, Ashm., *Eiphosoma* sp., *A. piliventris* and *Winthemia* sp. were observed in 1942 in Trinidad. *A. piliventris* was the most abundant, though the percentage parasitism did not exceed 5. A small predacious Carabid also attacked *Laphygma*.

Larvae of *Heliothis armigera*, Hb. (*obsoleta*, F.) on maize can be reduced or controlled by repeated applications to the silks of lead-arsenate dust, which, however, may cause some scorching, cutting off the silks every five days, which removes the eggs and young larvae, and applying a suitable viscous fluid to the fully-extended silks at the point where they emerge from the husk. The eggs are parasitised by *Trichogramma* sp., and *A. piliventris*, *Winthemia* sp. and *Sarcophaga lambens*, Wied. (*Sarcodexia sternodontis*, Tns.) were reared from the larvae. In 1942, the principal damage to cobs in Trinidad was from Nitidulid beetles and grain weevils, which entered the sheaths where the tops had been destroyed by birds. *Euxesta stigmatias*, Lw., also occurs commonly on maize. The eggs are deposited below the tips of the sheath, and the larvae feed near the upper end of the ears or in the tracks of larvae of *H. armigera*.

Maize stored on the cob in a dry well-ventilated place after prolonged exposure to sun and wind remains free from infestation from grain weevils for about a month, but if the cobs are left to dry on the plant, they become infested before being harvested. Shelled maize with a moisture content below 10 per cent. stored in sealed moisture-proof and air-tight containers remains uninfested for long periods, but where these conditions are not fulfilled, it should be fumigated with carbon bisulphide at the rate of $3\frac{1}{2}$ cc. per cu. ft. space for 24 hours, which does not impair germination.

Pigeon peas [*Cajanus cajan*] are attacked in the Windward Islands by *Elasmopalpus rubedinellus*, Zell., and *Heliothis virescens*, F. Eggs of both are deposited on the flowers or young pods, and the newly-hatched larvae feed on the developing seeds. In preliminary trials in humid weather, in which a spray of lead arsenate was applied against the larvae before they entered the pods, the percentage infestation averaged 12·7 in the sprayed plots and ranged from 11·2 to 76 in the controls. Lead arsenate scorched the plants at 1 oz. per gal. but not at $\frac{1}{3}$ oz. *E. rubedinellus* was parasitised by *Eupelmus cushmani*, Crwf., *Apanteles etiellae*, Vier., *Microbracon* sp., an undescribed species of *Phanerotoma* and *Eiphosoma nigrolineatum*, Brullé, in Trinidad, but the only parasite reared from it in the Lesser Antilles was *M. thurberiphagae*, Mues. In Trinidad, the pods are punctured by Coreids, and Membracids feed on the stems, flowers and leaf-stalks.

The leaves of beans are attacked by beetles of the genera *Homophoeta* and *Cerotoma*, which also feed on the rootlets as both adults and larvae. The adults

on the leaves can be controlled by a spray of 1 oz. lead arsenate in 3 gals. water or Bordeaux mixture, and the larvae and pupae can be exposed by hoeing. *Corythucha gossypii*, F., and *Tetranychus* sp. feed on the lower surface of the leaves and in dry weather become sufficiently abundant to cause them to fall. Both are controlled by a spray of nicotine sulphate, and this and lead arsenate are also effective against leaf-rolling caterpillars. *Agromyza jucunda*, Wulp, mines the leaves, but is of little importance and is kept in check by parasites. Young pods of lima pole beans are attacked by Lepidopterous larvae, which bore into them, and in addition to the injury due to feeding provide a means of entry for fungi ; no effective control measure is known, but the loss is offset to some extent on well-grown plants. The only satisfactory method by which small-holders can protect leguminous seeds from attack by Bruchids is to shell, dry and fumigate them and store them in insect-proof bins and canisters. Repeated fumigation is necessary if they are stored in bags. Sun-drying and storing the seeds in insect-proof vessels or in bags or bins under a layer of sand 1–3 ins. thick or storing them in the pod are not reliable.

The flowers and young fruits of melons and cucumbers are frequently destroyed by larvae of a Pyralid, probably *Diaphania* (*Margaronia*) *nitidalis*, Stoll. The fruits can be protected by enclosing the flowers in cloth bags as soon as pollination has been effected. Larvae of *D.* (*M.*) *hyalinata*, L., and adults of *Diabrotica* spp. feed on the leaves, attack by the latter being accompanied by a powdery mildew that causes the stems and leaves to collapse. Spraying the plants every week or the newly-matured leaves every 3–4 days with 4 oz. lead arsenate in 6 gals. water controls the leaf-feeding insects, but the risk of scorching under the humid conditions of the Lesser Antilles is high, and a concentration of 3 oz. in 6 gals. should first be tried. *Plutella maculipennis*, Curt., and *Ascia monuste*, L., are the principal pests of cabbage and cauliflower in the Lesser Antilles and the latter is also a serious pest of watercress. Control is given by hand collection of the eggs and larvae and sprays containing nicotine sulphate or lead arsenate. Arsenical residues can be removed by rinsing the leaves in a solution of $1\frac{1}{2}$ fl. oz. hydrochloric acid and 2 oz. common salt in 100 fl. oz. water. *Brevicoryne brassicae*, L., occasionally occurs on the leaves in large numbers and can be controlled by spraying with nicotine sulphate and soap or by 1 lb. soap in 6 gals. water. Larvae of *Psara bipunctalis*, F., feed on the leaves of beet, *Amarantus* and *Celosia*, portions of which they join together with silk to form a shelter, and can be destroyed by lead-arsenate sprays or by hand. Leaves of egg-plant [*Solanum melongena*] are attacked by *Corythaica monacha*, Stål, and Aphids, both of which are controlled by spraying the lower surfaces of the leaves with nicotine sulphate, and by flea-beetles, which are less injurious and can be checked by sprays of lead arsenate or possibly by covering the leaves with fine dust. Ants often construct their nests at the base of these plants and are best destroyed by digging up the soil and soaking it slowly and copiously with water.

Euscepes postfasciatus, Fairm. (*batatae*, Waterh.) is the chief pest of sweet potato in the Lesser Antilles. The adults feed on the leaves and oviposit on the stems, roots and tubers. The larvae bore into the plant and feed for rather more than a fortnight. Under wet conditions, this weevil is of little importance. It appears to have no effective parasites, but *Heterospilus* sp., which has been recorded as parasitising it in Grenada, also occurs in St. Vincent. Only uninfested slips should be planted, and the leaves should be sprayed with lead arsenate during the growing period to kill or repel the ovipositing adults. In moist areas, the tubers can be left in the ground and dug as required with comparatively little risk of infestation.

Other pests dealt with more briefly include *Mormidea ypsilon*, L., and *Conocephalus saltator*, Sauss., both of which attack the grains of hill rice in the Windward Islands, and *Contarinia sorghicola*, Coq., on *Sorghum*.

Directions for preparing various sprays, dusts and poison baits and rates of application for carbon bisulphide are appended.

ADAMSON (A. M.). **Termites and the Fertility of Soils.**—*Trop. Agriculture* **20** no. 6 pp. 107–112, 26 refs. Trinidad, 1943.

This discussion on the effect of termites on soil fertility is based partly on the author's observations in Trinidad, where there is a rich termite fauna of continental origin [*cf. R.A.E.*, A **27** 55 ; **28** 496] and many species appear to feed by ingesting soil in the same way as earthworms. Brief general descriptions are given of the status of termites in typical natural forests in Trinidad, particularly in areas of moderate to heavy rainfall (70–110 ins. per year), where the decay and complete disintegration of dead wood is greatly accelerated by enormous numbers of them, large quantities of soil are weathered by being carried above the surface of the ground, and innumerable subterranean passages occur ; in cultivated forest, such as cacao, rubber or teak plantations and natural forest in relatively dry areas (50–70 ins. rain per year), where there is less activity ; and in cultivated fields, where the termite fauna is so reduced that it probably has little effect on the nature of the soil. The families and genera are classified as dry-wood termites, which seldom enter the soil, and soil dwellers, which comprise exclusively subterranean termites, builders of exposed nests and termites that build subterranean nests but seek food above the ground, and their feeding habits and the building materials used are described.

Termites contribute to the formation of humus by promoting the disintegration of vegetable remains and accelerate its incorporation into the soil by bringing soil above ground and carrying organic matter underground ; they may, however, considerably reduce the organic content of the soil by consuming humus or vegetable remains that would ultimately form humus. The predominance of formation or destruction depends on differences in the soil, vegetation and habits of the termites in each locality. Termites probably promote the cycle of nutrient mineral elements in the soil, but the accumulation of calcium carbonate in some mounds may reduce the lime content of the surrounding soil seriously, while increasing the fertility of soil formed by the decay of abandoned mounds [*cf.* **30** 322]. Abandoned subterranean burrows probably facilitate aeration, the infiltration of water and the penetration of roots into compact soil, but the collection of blades of living grass by termites of the genus *Hodotermes* may denude the ground in the vicinity of nests on African plains, resulting in considerable soil erosion after periods of drought [*cf.* **23** 377]. The growth of epiphytic plants, which are abundant and varied in Trinidad and often have their roots surrounded by large amounts of earthy material, is probably promoted by termite activity and may in some cases depend on it.

CALLAN (E. McC.). **Observations on Cotton Stainers** (*Dysdercus* **spp.) and their Host Plants in Jamaica.**—*Trop. Agriculture* **20** no. 6 pp. 113–115, 10 refs. Trinidad, 1943.

Success in the growing of cotton in Jamaica would depend on the control of insect pests of which the most important are species of *Dysdercus* ; *D. andreae*, L., *D. sanguinarius*, Stål, and *D. mimulus*, Hussey, are common, and *D. suturellus*, H.-S., may possibly occur rarely. The most satisfactory methods of control are to destroy the alternative food-plants or to evade the main attack by adjusting the time of cotton planting, for both of which a knowledge of the food-plants and their distribution, ecology and fruiting phases is essential. Observations in 1942 showed that *Ceiba pentandra* can support very considerable populations and is probably the most important ; other woody food-plants of

importance include *Ochroma pyramidale*, *Cola acuminata*, *Thespesia populnea*, *Hibiscus elatus* and *H. tiliaceus*. Malvaceous weeds, including *Sida acuta*, *S. rhombifolia*, *Urena lobata*, *Malvastrum coromandelianum* and *Wissadula periplocifolia*, fruit perennially and support large populations.

Posnette (A. F.). **Control Measures against Swollen Shoot Virus Disease of Cacao.**—*Trop. Agriculture* **20** no. 6 pp. 116–123, 1 fig., 8 refs. Trinidad, 1943.

The swollen shoot disease of cacao in the Gold Coast Colony [*cf. R.A.E.*, A **30** 104] has been shown to be transmitted by certain mealybugs, the Psyllid, *Mesohomotoma tessmanni*, Aulm., and the Aphid, *Toxoptera aurantii*, Boy., all of which are common, and it is unlikely that control of the vectors will be practicable. Elimination of infected trees is thus the only available method. The disease spreads by the infestation of trees adjacent to those already affected, resulting in the gradual enlargement of an outbreak, and also by the formation of scattered outbreaks some distance away, probably as a result of the dispersal of vectors from the initial outbreak, but possibly owing to fresh infection from an alternative host-plant or other source. The history of control measures on the Cocoa Research Station at Tafo is described, with data to show the degree of success obtained. In spite of increased frequency of outbreaks, in 1942 the annual loss of trees was reduced to only a third of that in 1940 by preventing the spread from tree to tree. The results of an experiment to compare the value of felling infected trees and one or two rings of healthy trees round them, when no added treatment was given, when infected trees and all within 20 yards of them were sprayed with nicotine sulphate (1 : 1,500) before and during felling, and when all leaves and green wood were scorched immediately after felling, showed that none of these methods was completely effective in eradicating large outbreaks of the virus in one operation, and it is concluded that since repeated treatment is usually necessary, control can be effected most economically by removing only one ring of trees showing no symptoms with those definitely infected. Outbreaks of less than six infected trees can sometimes be controlled by destroying only those showing symptoms of the disease.

Callan (E. McC.). **Thrips Resistance in Cacao.**—*Trop. Agriculture* **20** no. 7 pp. 127–135, 3 refs. Trinidad, 1943.

An account is given of investigations on the resistance of cacao to *Selenothrips rubrocinctus*, Giard, begun in Trinidad in 1939. Trees with few or no thrips on the leaves when the surrounding ones were heavily infested, those that had withstood a severe attack and retained their leaves when the surrounding trees were defoliated, and those with thick leathery leaves bearing no signs of thrips injury were selected as showing resistance in the field, the first of these criteria being considered the most reliable. Desirable commercial types giving a high yield were desired, and notes were therefore kept of the incidence of witches' broom disease, caused by the fungus, *Marasmius perniciosus*, on the selected types. Of the 30 apparently resistant trees selected, 27 were found in Trinidad and three in Grenada. Population counts were made on these and on control trees immediately surrounding them in 1939–41; and disks cut from thoroughly hardened leaves were used for food-preference tests, in which first-instar larvae of the thrips, obtained from the leaves of cashew (*Anacardium occidentale*), were placed on them and the subsequent distribution of the thrips and of excrement spots was noted. These field and laboratory observations both showed that two of the Trinidad trees, RT 18, which represents a good commercial type of cacao, and RT 17, which is a poor type, were significantly less attractive to the thrips than the standard types. Obligatory food tests, in which the thrips were given no choice of food, made with thoroughly

hardened leaves and with propagated buddings and cuttings of RT 18 and a standard type, confirmed this, most of the larvae dying or leaving the leaves of RT 18 before completing their development. An experimental block of RT 18 and a standard was therefore established, and population counts in 1940 and 1941 showed that the standard type had consistently a significantly greater population than RT 18, the population on the former being on the average more than 7·5 times as great.

A formula is given for expressing the thrips resistance of a cacao type as a coefficient, that of a susceptible type being taken as 0 and that of hypothetical immune type as 1 ; the mean coefficient of RT 18 was 0·87. It is considered that the resistance of cacao to thrips is attributable rather to the resistance of the leaf to puncturing than to any plant characters associated with the growth habit.

Husain (M. A.) & Trehan (K. N.). **The Nature and Extent of Damage caused by *Bemisia gossypiperda* M. and L., the White-fly of Cotton in the Punjab.**—*Indian J. agric. Sci.* **12** pt. 6 pp. 793–821, 1 pl., 2 figs., 28 refs. Delhi, 1942.

Though Aleurodids are serious pests of various crops, little is known of the precise nature of the injury caused. Investigations were therefore carried out in 1931–36 at Lyallpur with *Bemisia tabaci*, Gennadius (*gossypiperda*, Misra & Lamba) on cotton, to which it causes no visible structural malformation, though fruiting is affected [*cf. R.A.E.*, A **22** 200]. It was sought to determine in what manner the insects damage the foliage or entire plant, and the effect of attack on the total dry-weight of the aerial parts of the plant and on its growth, the formation of flowers and bolls and the development of lint and seed. Comparison of uninfested and infested plants in cages showed that the percentage moisture is higher in the former and the ratio of carbohydrate to nitrogen lower (a condition that has been shown to stimulate the vegetative and reproductive growth of the plant) ; the nitrogen content of the bolls is significantly higher and that of the leaves is higher until the middle of August, after which it may rise in the foliage of infested plants ; a much higher percentage of nitrogen, ash and fat is transported from the vegetative to the reproductive organs ; and the total dry matter produced as a result of growth is much greater. During severe infestation, the vegetative growth is checked and may be almost stopped. Boll formation decreases and shedding and unsatisfactory opening of bolls increase with the intensity of infestation. It is considered that the reduction of bolls on infested plants may be the result of some dislocation in the carbohydrate and protein balance. Infestation is more injurious late in the season.

It has been stated by Mathur that *B. tabaci* transmits leaf-curl of *Zinnia* at Dehra Dun [*cf.* **21** 644 ; **29** 183] and that this disease is similar to the leaf-curl of cotton [*Ruga gossypii* of Holmes] that it transmits in the Sudan. The latter does not occur in the Punjab, though a disease of cotton known as " smalling " does. In experiments in 1932–33 adults of *B. tabaci* collected from malformed leaves of *Zinnia* and dwarfed cotton plants or bred from nymphs on them were liberated on healthy seedlings of cotton and *Zinnia*. No transmission of leaf-curl or smalling occurred, and it is concluded that the Aleurodid is not a vector of either disease in the Punjab.

Padmanabha Aiyar (K. S.). **Notes on two major Caterpillar Pests of *Eugenia jambos* (Rose Apple).**—*J. Bombay nat. Hist. Soc.* **43** no. 4 pp. 673–675, 1 pl. Bombay, 1943.

Eugenia jambos, which is grown for shade, ornament and fruit in private gardens in Travancore, produces fresh shoots twice a year, after the monsoons. These shoots are attacked by a number of insects, including *Metanastria hyrtaca*,

Cram., *Thalassodes flavifusata*, Wlk., *Homona coffearia*, Nietn., and a weevil of the genus *Apoderus*, but the most important are *Argyroploce mormopa*, Meyr., and the Noctuid, *Bombotelia delatrix*, Gn., which often cause serious damage. The eggs of both these moths are laid singly on the young leaves. The larvae of *Bombotelia* hatch in 3–4 days, feed on the leaves for 12–14 days and spin cocoons in which the pupal stage, lasting about 13 days, is passed. No adults emerged from half the pupae formed by larvae collected in the field and reared in the insectary, and these were all found to contain Tachinid pupae. The larvae of *Argyroploce* hatch in 4–5 days and web together the young leaves at the end of the shoot. They feed within this shelter for about 18 days and pupate there, the pupal stage lasting 7 days.

Rahman (K. A.) & Asa Nand Kalra. **Tent Caterpillar (*Malacosoma indica* Wlk.) in the Simla Hills.**—*Proc. Indian Acad. Sci.* Sec. B **18** no. 2 pp. 41–44. Bangalore, 1943.

Notes are given on the bionomics of *Malacosoma indica*, Wlk., in the Simla Hills [*cf. R.A.E.*, A **30** 584] and all stages are described. Apple is the preferred food-plant, and up to 50 per cent. of the trees are sometimes attacked. The larvae can be killed by rubbing the nests with rags dipped in kerosene and tied to the end of a pole. This gave the best results when carried out in the early afternoon on clear sunny days. A dish of water with a film of kerosene on it was placed on the ground so that the dislodged larvae fell into it.

Gadd (C. H.). **Shot-hole Borer and Wood Rot.**—*Tea Quart.* **16** pt. 1 pp. 6–9, 3 refs. Talawakelle, 1943.

It has been suggested that the discoloration of wood round galleries constructed by *Xyleborus fornicatus fornicatior*, Egg., in the branches of tea in Ceylon is due to the beginning of infestation by wood-rotting fungi and not to the ambrosia fungus introduced by the beetle. An attempt to prove this in 1935 gave negative results [*cf.* also *R.A.E.*, A **29** 381], but it was observed by a planter that infested branches cut at one pruning were severely rotted by the time of the next pruning. Further investigations were therefore made to determine whether the galleries provide a means of entry for wood-rotting fungi or whether invasion of the galleries by other fungi renders the wood more susceptible to infection or causes it to decay more rapidly when attacked. The observations were made on prunings taken from stems that had been pruned three years earlier and obtained by cutting these stems at a point 3 ins. below the base of the side-branch that had developed as a result of the earlier pruning ; only those in which the diameter at the previous cut exceeded $\frac{1}{2}$ in. [**30** 232] and that had no other injuries were used. The length of the die-back in the main stem above the side-branch and the length of the main stem infected with wood-rot were measured for each sample, and both were found to be approximately twice as great in those in which galleries occurred in these regions as in those in which they did not. In the case of the die-back, this is attributed to the habit of the beetles of entering the stem at a leaf-scar, which frequently damages the bud immediately above it and prevents it from developing. No indication of the reason for the hastening of wood-rot in infested branches was obtained, but it is considered improbable that the fungi enter through the galleries.

Jenkins (C. F. H.). **The Cabbage Butterfly (*Pieris rapae* L.) a recently introduced Pest.**—*J. Dep. Agric. W. Aust.* (2) **20** no. 1 pp. 35–40, 3 figs. Perth, W.A., 1943.

The first Australian record of *Pieris rapae*, L., was from Victoria in 1939 [*R.A.E.*, A **28** 47], but by the end of 1940 it had reached New South Wales

[**29** 290], Tasmania [**30** 272] and South Australia. In spite of regulations prohibiting the importation into Western Australia of cabbage and other plants likely to harbour it, an adult was collected in a vegetable garden at Bassendean in January 1943, and examples were later found in other localities. Notes are given on its biology and the damage it causes to cruciferous crops, with brief descriptions of all stages and an account of the measures recommended for its control.

HARROW (K. M.). **Preliminary Notes on the Treatment of Australian Subterranean Termites in New Zealand.**—*N. Z. J. Sci. Tech.* **24** no. 1B pp. 47B–52B, 4 figs. Wellington, N.Z., 1943.

The author describes the measures carried out for the control of *Coptotermes acinaciformis*, Frogg., *C. frenchi*, Hill, and *C. lacteus*, Frogg., under the Termites Act, 1940 [*cf. R.A.E.*, A **30** 564]. These comprise thorough inspection of all wood at or below ground-level or connected with the ground, which will need to be continued for some time, owing to the difficulty of discovering colonies less than four years old, and treatment with arsenical dust blown into nests, galleries or runways containing active termites. The results are given of laboratory tests on *C. acinaciformis* to compare the toxicity of Paris green (average particle diameter 3·5μ), white arsenic (19μ) and lead arsenate. Workers were put in petri dishes containing the dusts, and after the dishes had been shaken to give them a good coating of the dusts, one was placed in each dish of a series containing 9, 24, 49, 74, 99 and 199 undusted workers ; several of the dishes also contained soldiers, and all were provided with moistened filter-paper on which the termites could feed. There was little difference in the time required to kill 10 or 200 individuals per dish with white arsenic, most workers being dead after two days and all after three. A small proportion were still alive three days after treatment with Paris green, and individuals treated with lead arsenate died almost as slowly as untreated ones. Soldiers were not readily poisoned by the dust, but died of starvation and fungous attack in the absence of workers.

In practice, the greater rapidity with which white arsenic kills does not necessarily make it more effective than Paris green, as in some cases it killed many of the termites passing through the treated runways before they could carry the poison back to the nest. Poisoning of *Coptotermes* was begun in February 1941, and by September, 146 infestations had been treated in Auckland and 5 in New Plymouth ; nests that were examined after treatment showed very successful control, and in many more no recurrence of activity was observed after several months. Examples are given of a number of cases of field treatment with arsenical dust that show its effectiveness in New Zealand.

It is concluded that the success of the control campaign in New Zealand depends on the completeness with which infestations are located, since it has been found that once a colony is discovered, eradication is readily effected with white arsenic or Paris green dusts blown into populated runways.

WOLCOTT (G. N.). **How to make Wood unpalatable to the West Indian Drywood Termite, *Cryptotermes brevis* Walker. I. With inorganic Compounds.**—*Caribb. Forester* **4** no. 4 pp. 145–157, 3 figs., 2 refs. Rio Piedras, P.R., 1943. (With a summary in Spanish.)

An account is given of experiments carried out in Porto Rico to determine the toxicity or repellency of common inorganic chemicals to *Kalotermes brevis*, Wlk., which is probably the most destructive termite in the Island and the most difficult to control, since it can live in dry wood within houses and does not construct exposed nests or tunnels. As, however, it attacks wood that is not generally exposed to rain, a satisfactory chemical repellent would not need to

be insoluble in water, and shallow penetration would be adequate. Samples of the wood of *Bursera simaruba*, which is very susceptible to attack, were dipped in aqueous solutions of about 40 inorganic compounds at different strengths for varying periods and allowed to dry until the following day. They were then fitted into petri dishes in contact with untreated samples of mahogany (*Swietenia mahagoni*), which was used as a basis of comparison, and other resistant woods, and subjected to attack by termites that had previously eaten only *Platanus occidentalis*. Wood dipped for ten minutes in a solution of approximately $\frac{3}{4}$ oz. copper sulphate, zinc chloride, barium chloride or cadmium nitrate per U.S. gal. water became more resistant to attack than the mahogany. In limited tests, combinations of repellent substances showed no increase in effectiveness. Since it is seldom possible to dip an entire piece of furniture, new furniture made of susceptible wood should be protected by painting or spraying the underneath and hidden parts, and particularly all cracks and crevices, where termite attack is most likely to occur, with a strong solution of a repellent chemical. Timber used in the construction of new houses should be painted after it is cut to fit, the ends being soaked in the solution for some hours if possible, or else sprayed after it is in position ; in either case, particular attention should be paid to crevices and nail holes.

Sodium arsenate and thallium acetate were found to be extremely toxic to the termites, but not repellent in small quantities, and it is suggested that introducing a solution of about 1 gm. sodium arsenate per 100 cc. water into the tunnels of infested wood might kill the existing colony and also prevent reinfestation.

CALLAN (E. McC.). **Cassava Weevil-borers of the Genus** *Coelosternus*.—**A Correction.**—*Rev. Ent.* **14** fasc. 1-2 pp. 30-31, 1 ref. Rio de Janeiro, 1943.

The author states that specimens of the weevils recorded from cassava in Trinidad as *Coelosternus tardipes*, Boh. [*R.A.E.*, A **31** 163] were submitted to Sir Guy Marshall, who identified them as *C. granicollis*, Pierce, and a probably undescribed species of the same genus.

BONDAR (G.). **Notas entomológicas da Baía. XI–XII.**—*Rev. Ent.* **14** fasc. 1–2 pp. 33-84, 10 refs., 85–134, 40 figs., 17 refs. Rio de Janeiro, 1943.

The first of these two parts of a series on insects in Bahia [*cf. R.A.E.*, A **31** 163] deals with weevils that infest Cyperaceae, and includes descriptions of many new species.

In the second part, *Lyctus brunneus*, Steph., which had previously been reported only twice from Brazil [**9** 59 ; **22** 504], is recorded from structural timber in the State of Espirito Santo, and brief notes are given from the literature on its morphology, bionomics and control. The larvae and pupae were attacked by an unidentified Hymenopterous parasite. Larvae and adults of *Phelypera pachirae*, Mshl., a weevil that was described from *Pachira insignis*, which is grown in Bahia as a shade tree and for its oleaginous seeds, were observed in 1943 defoliating *Pachira aquatica* in the streets of Bonfim. The females oviposit on the leaves, and the larvae are gregarious and partly cover themselves with excreta. Unlike the larvae of other weevils, they have 12 pairs of prolegs, move rapidly and pupate in silken cocoons on the petioles and twigs. Development probably lasts little more than a month. Many of the larvae and pupae in the cocoons were parasitised by Hymenoptera.

The rest of the part comprises notes on the morphology and habits of weevils of the genus *Spermologus*, of which one is described as new and all develop in fallen oleaginous seeds, and records of Barine weevils, including many new species, that feed on dicotyledonous plants and on Marantaceae in

Brazil. The only species of *Spermologus* of economic importance is *S. rufus*, Boh., which infests stored cacao beans [*cf.* **12** 28]. During attempts in 1932–37 to find the original food of this weevil, adults were also bred from cacao beans lying on the ground in plantations.

FERREIRA LIMA (A. D.). **O gorgulho das orquídeas.** [A Weevil infesting Orchids.]—*Bol. Soc. brasil. Agron.* **6** no. 2 pp. 157–158, 1 fig. Rio de Janeiro, 1943.

Orchids of the genera *Laelia* and *Cattleya* in an orchid house on Santa Catarina Island, Brazil, were found in 1942 to be severely damaged by an unidentified species of *Diorymerellus*. The eggs of this weevil were laid in the floral buds, and the larvae fed in the buds and pupated in the soil or on the litter in the pots.

VENABLES (E. P.). **The Clover Seed Weevil, *Tychius picirostris* (Fab.), in British Columbia (Coleoptera).**—*Canad. Ent.* **75** no. 6 p. 118. Guelph, Ont., 1943.

Large numbers of *Tychius picirostris*, F., which was first reported from North America in 1934 [*R.A.E.*, A **23** 41], were observed in Vernon, British Columbia, in June 1937 ovipositing in the blossoms of white Dutch clover. Only a few were found on lucerne and red clover growing close at hand. This weevil was collected from willows in three other localities in British Columbia between 1924 and 1930, and from *Pinus contorta latifolia* in another in 1933. It has also been beaten from white pine [*Pinus strobus*] and spruce in the course of work in the Forest Insect Survey.

KNOWLTON (G. F.) & STAINS (G. S.). **Flickers eat injurious Insects.**—*Canad. Ent.* **75** no. 6 p. 118. Guelph, Ont., 1943.

Details are given of the insects found in the stomachs of 16 individuals of *Colaptes cafer collaris* collected in Utah between 1935 and 1941. The stomach contents consisted principally of several thousand ants and much smaller numbers of other injurious insects, which included *Lygus hesperus*, Knight, *L. elisus*, Van D., *Nysius ericae*, Schill., *Hypera variabilis*, Hbst. (*Phytonomus posticus*, Gylh.), Scolytids, termites and a nymph and eggs of grasshoppers.

LAWSON (F. R.) & PIEMEISEL (R. L.). **The Ecology of the principal Summer Weed Hosts of the Beet Leafhopper in the San Joaquin Valley, California.**—*Tech. Bull. U.S. Dep. Agric.* no. 848, 37 pp., 11 figs., 16 refs. Washington, D.C., 1943.

This bulletin contains further information on the situation and size of the areas of weeds that serve as food-plants of the beet leafhopper (*Eutettix tenellus*, Baker) in summer, the persistence of the weeds on the same ground from year to year, the fluctuation in the acreages they occupy and the factors that influence their increase or decrease [*cf.* *R.A.E.*, A **26** 322], based on the results of detailed surveys of the distribution and abundance of the plants in the San Joaquin Valley of California in 1931–37, supported by extensive observations in California, Idaho and other States. The important summer food-plants are Russian thistle (*Salsola pestifer*), bractscale (*Atriplex serenana*) and fogweed (*A. expansa*) ; they are found on many different types of soil, but are practically limited to the valley floor and adjacent sloping plains. All three are abundant on land that is intermittently farmed or has been recently abandoned. Russian thistle, which is the most important because of its occurrence near the spring breeding grounds of the leafhopper and its suitability

as a food-plant, and, to a less extent, fogweed also occur abundantly on old abandoned land now used for grazing. Grain was the only crop in which the summer food-plants were abundant. In the grazing lands the areas occupied by Russian thistle are marked by sudden shifts in situation and size from year to year, with the boundaries overlapping, but with the spread more often on the leeward side. This species and fogweed are tumbleweeds and scatter their seed as they are blown along by the wind, the bulk of it being dropped before the plants have gone very far. In individual areas, the summer food-plants were rapidly replaced by other plants, usually winter annuals, since though they germinate early in the spring, they grow very slowly before the coming of warm weather and cannot compete successfully with the latter, which germinate in autumn and are well established by early spring. They compete with both the winter annuals and other summer annuals for the available soil moisture. Rainfall early in the season favours the growth of the winter annuals and is a disadvantage to the Russian thistle, but rains coming late, after the winter annuals have matured, favour the latter. The effects of rainfall and competition on bractscale and fogweed are similar.

The summer food-plants can be reduced in abundance by direct measures, such as the destruction of the growing plants or the seed supply, and in the cultivated districts these may be the most practical methods of control, but on grazing land the best method would be the control of overgrazing, which makes conditions suitable for the growth of these weeds by greatly thinning the winter annuals.

TELFORD (H. S.) & MUNRO (J. A.). **Sweet Clover Weevil Investigations.**—*Bi-m. Bull. N. Dak. agric. Exp. Sta.* **5** no. 6 pp. 16–17. Fargo, N. Dak., 1943.

Sitona cylindricollis, Fhs., defoliates first- and second-year plantings of sweet clover [*Melilotus*] throughout North Dakota [*cf. R.A.E.*, A **31** 205] and often kills the first-year seedlings. Investigations made in the summer of 1943 indicated that there was little difference in the relative susceptibility to attack of seven varieties of sweet clover, but that the extent of the injury varied inversely with the density of the stand and diminished as the season progressed. Varieties that produce much foliage early in the season should therefore be grown and seeding rates should be increased to offset the effects of early defoliation. Preliminary observations indicated that late sown stands are less frequently attacked than early ones.

PAPERS NOTICED BY TITLE ONLY.

HAYWARD (K. J.). **El escarabajo o cascarudo rinoceronte** (*Strategus validus* (**Fabricius**)) **y la caña de azúcar.** [*S. validus* and Sugar-cane in Argentina.].—*Rev. industr. agríc. Tucumán* **32** (1942) no. 10–12 pp. 333–335, 3 figs., 3 refs. Tucumán, 1943. [*See R.A.E.*, A **31** 454.]

POOS (F. W.) & WHEELER (N. H.). **Studies on Host Plants of the Leafhoppers of the Genus** *Empoasca*.—*Tech. Bull. U.S. Dep. Agric.* no. 850, 51 pp., 21 figs., 130 refs. Washington, D.C., 1943.

WEED (A.). **Insect Kill. The Action of Insecticides on Insect Tissue.** [A review of the literature.]—*Soap* **19** no. 6 pp. 117, 119, 121, 21 refs. New York, N.Y., 1943.

IMPERIAL INSTITUTE. **Quarterly Bibliography on Insecticide Materials of Vegetable Origin, Nos. 21–23 (October 1942 to June 1943).**—*Bull. imp. Inst.* **41** nos. 2–3 pp. 108–116, 116–121, 181–188. London, 1943. [*Cf. R.A.E.*, A **31** 136.]

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